1988

1988 ANNUAL REPORT

Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

JUNE 1989

Prepared by the Plan Monitoring Team for the

WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

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cover photograph: Aboard the F/V WICKED WAHINE, Wayne Higashi displays some of the catch from a fishing trip to the Northwestern Hawaiian Islands, while Kurt Kawamoto and Joe Tsugawa help offload the catch.

INTRODUCTION

In the western Pacific, the dominant bottomfish species, i.e., snappers, jacks, groupers and emperorfishes, are typically caught with handlines on banks and slopes ranging from shallow reef flats to depths of about 200 fm. Other groundfish, including armorhead and alphonsins, inhabit the region's seamounts and have been subjected to intense fishing pressure in the past (there is currently a moratorium on fishing for these species in the U.S. EEZ).

In August, 1986, the National Marine Fisheries Service (NMFS) implemented a Fishery Management Plan (FMP) for the bottomfish and seamount groundfish fisheries in the western Pacific. The FMP was developed by the Western Pacific Regional Fishery Management Council (Council) and is designed to both conserve and prudently develop bottomfish stocks in Hawaii, American Samoa, Guam and the Commonwealth of the Northern Mariana Islands. The FMP was amended to implement program of limited-entry to the NWHI bottomfish fishery in January, 1989. This will greatly change the dynamics of the fishery in the future.

The FMP requires a review of these fisheries to be prepared annually by the Council's Plan Monitoring Team (Team), which is made up of government and industry representatives who are knowledgeable about the fishery. The yearly report aims to document changes and problems in the fishery, examine solutions to existing or potential problems, and develop recommendations for management action by the Council and other agencies. Although this year's report considers commercial landings only, recreational and subsistence harvests may, in some instances, exceed commercial landings. Information on these non-commercial harvests is a high priority for the future.

The regulations of the FMP specify the information needed to effectively manage bottomfish resources. This includes:

Fishery performance data
Recent research and survey results
Habitat conditions and recent alterations
Enforcement activities and problems
Administrative actions (data collection, reports, permits)
State and territory management actions
Assessment of need for council action
Recommendations for council action (if any)
Estimated impacts of recommended action (if any)

In previous reports, information about these topics was arranged in the above order. For 1988, however, the Team took a

different approach. This introduction contains a synopsis of fishery conditions and is followed by seven appendices; these are detailed reports from various authors on different segments of the fishery. Information on the biological status of Hawaii's fishery is contained in the module by Somerton, Everson and Kikkawa (Appendix 1); the module by Kawamoto and Pooley (Appendix 2) contains economic information about Hawaii's fishery, including the volume of landings, revenues and vessel performance (this appendix represents a draft report on work in progress). Appendix 3 is the module by Hamm, Quach and Aitaoto concerning American Samoa's fishery. Guam's fishery is covered in Appendix 4, the module by Hamm, Quach and Davis. In Appendix 5, the fishery in the Northern Mariana Islands is discussed by Hamm, Quach and Donaldson. Habitat conditions and administrative actions are discussed in the module by Naughton (Appendix 6), and enforcement activities are found in Appendix 7, the module by Witham. Because of differences in data conventions and continued revision of the data sets, differences may exist among the data presented in these reports, and between this year's report and previous reports.

Another feature of this year's report is the inclusion in the introduction of Tables 1-4, each of which contains 14 fishery indicator conditions. These indicators were specified in the FMP to monitor fishery conditions in each area; they provide a common set of topics to be monitored by the Team, and help to establish research and management priorities. The indicator criteria have been addressed in previous reports, but not in a tabular format. The use of tables provides an at-a-glance review of the fishery, and detailed discussion of the indicators is contained within the module(s) for the region in question.

Table 1. Indicator criteria for HAWAII, including the NWHI

	Problem or Condition	Present in Bottomfish Fishery?	Comment
1.	Size at entry is prereproductive	Yes	MHI: entry size is prereproductive for opakapaka onaga, ehu and white ulua; NWHI: entry size is prereproductive for onaga
2.	Unacceptable ratio of fishing mortality to natural mortality	Unknown	Possible in MHI, unlikely in NWHI
3.	Catch exceeds MSY	Yes	MHI: FMP estimate of MSY was exceeded in 1988; NWHI: FMP estimate of MSY was not exceeded
4.	Significant decline in CPUE	Unknown	1988 catch rates declined from 1987, but "significant" needs to be quantified
5.	Substantial decline in ex-vessel revenues relative to baseline levels	No	
6.	Significant shift in gear, by area	No	
7.	Significant change in the frozen/fresh components of catch	No	
8.	Unstable pattern of entry/exit to the fishery	Yes	Decline in number of vessels (50%) and trips (45%) from 1987 in the NWHI; unknown for MHI
9.	Per trip costs exceed per trip revenue	No	

10.	Significant decline or increase in total bottomfish landings	Yes	Large decrease in NWHI catch and large increase in MHI catch, but "significant" needs quantitative definition
11.	Change in species composition of catch	Yes	Uku catch up 1000% and opakapaka up 200% in MHI; stable in NWHI
12.	Research results indicate problems	No	
13.	Habitat degradation or environmental problems	No	
14.	Increased interaction with protected species	No	

Table 2. Indicator criteria for AMERICAN SAMOA

	Problem or Condition	Present in Bottomfish Fishery?	Comment
1.	Size at entry is prereproduction	Unknown	
2.	Unacceptable ratio of fishing mortality to natural mortality	Unknown	
3.	Catch exceeds maximum sustainable yield	No	
4.	Significant decline in CPUE	No	
5.	Substantial decline in exvessel revenue relative to baseline levels	No	WPRFMC/DMWR/NMFS vessel economics survey data being processed by Honolulu Laboratory
6.	Significant shift in gear by area	No	
7.	Significant change in the frozen/fresh components of catch	Unknown	Due to a new fishery regulation, these data will be available in 1990
8.	Unstable pattern of entry/exit to the fishery	Yes	1988 recovery after drastic 1987 decline
9.	Per trip costs exceed per trip revenues	Unknown	Data available in 1990; refer to item 5 above

10.	Significant decline or increase in total bottom-fish landings	No	
11.	Change in species composition of catch	No	
12.	Research results indicate problems	No	
13.	Habitat degradation or environmental problems	Unknown	Hurricane in 1987; no follow-up on initial survey
14.	Increased interaction with protected species	No	

Table 3. Indicator criteria for GUAM

	Problem or Condition	Present in Bottomfish Fishery?	Comment
1.	Size at entry is prereproductive	Unknown	
2.	Unacceptable ratio of fishing mortality to natural mortality	Unknown	
3.	Catch exceeds MSY	No	
4.	Significant decline in CPUE	No	
5.	Substantial decline in ex-vessel revenue relative to baseline levels	Maybe	Fishery revenues have declined, but "substantial" has not yet been quantified
6.	Significant shift gear, by area	No	
7.	Significant change in frozen/fresh components of catch	No	
8.	Unstable pattern of entry/exit to the fishery	Maybe	Pattern changed, but need to quantify "unstable"
9.	Per trip costs exceed per trip revenue	Unknown	Survey results will be available later
10.	Significant decline or increase in total bottomfish landings	Maybe	Large decline in 1988, but need to quantify "significant"

11.	Change in species composition of catch	No
12.	Research results indicate problems	No
13.	Habitat degradation or environmental problems	No
14.	Increased interaction with protected species	No

Table 4. Indicator criteria for the NORTHERN MARIANA ISLANDS

	Problem or Condition	Present in Bottomfish Fishery?	Comment
1.	Size at entry is prereproductive	Unknown	
2.	Unacceptable ratio of fishing mortality to natural mortality	Unknown	
3.	Catch exceeds MSY	No	FMP estimate of MSY not reached, but localized depletion problems may exist
4.	Significant decline in CPUE	No	
5.	Substantial decline in ex-vessel revenues relative to baseline levels	Maybe	More trips were needed by highliners to obtain the same catch as last year
6.	Significant shift in gear, by area	No	
7.	Significant change in the frozen/fresh components of catch	No	
8.	Unstable pattern of entry/exit to the fishery	Yes	Fewest fishers since 1982, steady decline
9.	Per trip costs exceed per trip revenue	Unknown	Survey results will be available later
10.	Significant decline or increase in total bottomfish landings	No	

11.	Change in species composition of catch	Yes	More onaga landed in 1988, but this due to a single fisher new to the fleet
12.	Research results indicate problems	No	
13.	Habitat degradation or environmental problems	No	
14.	Increased interaction with protected species	No	

RECOMMENDATIONS

A review of the above tables suggests that several topics in the bottomfish fishery require more careful monitoring and further research. Thus, the Team makes the following recommendations:

GENERAL

1. The Team should develop specific recommendations regarding the format and content of the annual report modules. In addition, some criteria indicators should be modified to be as quantitative as possible. MSy should be re-estimated for each area, and terms such as "significant" and "substantial" should be defined in rigorous statistical terms.

2. The Team should identify specific questions about the fishery, form hypotheses to answer the questions, determine methods to test the hypotheses, provide guidelines for interpreting the analyses, and determine what real trends, changes and problems exist in the fishery. A special 2- to 5-day workshop should be held, possibly in concert with the Pelagics Team and certain members of the Council's Scientific and Statistical Committee, to resolve these problems. To date, visual interpretations have been used on most of the data, but these fisheries have undergone tremendous fluctuations, and more rigorous analyses should be performed on the data to determine whether or not problems actually exist.

AMERICAN SAMOA

1. The selection process for finding suitable candidates to serve on panels and as Council members should be improved. Some delegates appear to interact with the Council in a less-that-optimal fashion.

2. The DMWR should further improve the species identification of bottomfish catches. A further 10% improvement is recommended for 1989.

3. A NMFS Honolulu Laboratory scientist should be assigned to work with DMWR biologists. This would be for the continuation of the joint project to assess bottomfish stocks in American Samoa.

4. The WPACFIN program should complete the computer programming for the Team's annual report modules for American Samoa. Existing computer programs for summarizing and analyzing available data are insufficient to describe the fishery and properly monitor the resources. Assistance is needed to develop these tools for use by the DMWR Team member in preparation of future annual reports. If the programming is completed by November, 1989, the DMWR can use it to prepare the American Samoa government's 1989 annual report on the offshore fisheries, thereby eliminating the need to reproduce identical information in different formats.

GUAM

1. The Guam commercial landings recording system should be expanded. WPACFIN personnel currently collect and process the commercial landings and effort data for Guam. The DAWR yearns to help in this effort, but its jurisdiction is limited to recreational and subsistence fisheries because all of its funding is through the Dingell-Johnson program and, therefore, cannot be used for commercial activities. If the Guam report module is to include commercial data, a mechanism must be developed to support DAWR's involvement in commercial fisheries.

2. A study of the size-frequency distribution of important commercial bottomfish species in Guam should be performed. The study should include complete analyses of existing data and a sampling program capable of obtaining information suitable for adequately describing the current stock structure.

HAWAII:

1. International management of seamount groundfish resources. The current fishing moratorium on the Hancock Seamounts appears to have preserved a brood stock of armorhead, but this stock may be insufficient to allow significant population growth to occur, either on the Southeast Hancock Seamount or the entire group of seamounts that once supported the fisheries.

2. Enhanced market sampling for bottomfish in the MHI. A broader, more reliable sample (including average size of fish per lot), will ensure that our current information accurately reflects conditions throughout the fishery and the market, and will help us estimate the impact of

potential management measures on different locations through the MHI.

NORTHERN MARIANA ISLANDS

1. A study on the size-frequency distribution of important commercial bottomfish species in the Northern Marianas should be performed. The study should include complete analyses of existing data and a sampling program capable of obtaining information suitable for adequately describing the current stock structure. In order to complete this task, the CNMI commercial landings system needs to be expanded.

ACKNOWLEDGEMENTS

The Team thanks Robert Harman, Council Staff Biologist, for his help in compiling and editing this report. The Hawaii Division of Aquatic Resources provided the cover photograph.

APPENDIX 1

BIOLOGICAL ASSESSMENTS OF THE HAWAII BOTTOMFISH STOCKS AND THE SOUTHEAST HANCOCK SEAMOUNT ARMORHEAD STOCK, 1988

JUNE 1989

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FOR THE

Western Pacific Regional Fishery Management Council's

BOTTOMFISH PLAN MONITORING TEAM

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SUMMARY

The Hawaiian bottomfish resource comprises 10 major species, including seven snappers, two groupers and two jacks. Opakapaka, Pristipomoides filamentosus, is the most important species and accounted for 29% of the estimated total catch in 1988. Next in importance are uku, Aprion virescens (28%), onaga (Etelis coruscans (14%)and hapuupuu, Epinephelus quernus (11%). Several major changes in the species composition of the catch occurred in 1988. In the main Hawaiian Islands (MHI), the catch of uku increased to 10 times the 1987 catch, and the catch of opakapaka increased to almost twice the 1987 catch. In the Northwestern Hawaiian Islands (NWHI), the catch of opakapaka decreased to almost half the 1987 catch.

In the NWHI, total catch of all species combined, and of opakapaka alone, declined in 1988 after reaching record highs in 1987. These decreases were precipitated by decreases in catch per trip and total number of trips. An additional change in the NWHI fishery was that effort became more equally distributed among various islands of the NWHI, suggesting that most of the localized opakapaka "hot-spots" have been found and the fishing-up phase of the NWHI fishery is nearing its end.

The biological assessment of the stocks was based on weight-frequency data collected at the wholesale markets in Honolulu. For nearly all species, the size of the fish caught in the NWHI was considerably larger than in the MHI. Although this indicates that the past fishing pressure was greater in the MHI, it is not possible to use this information to quantitatively assess whether the fishing effort is excessive either in the sense of growth over-fishing or recruitment over-fishing. However, in the MHI the apparent fishing rates are high, and the sizes at entry to the fishery are below the size at maturity for opakapaka, onaga, ehu and white ulua, suggesting that the reproductive population could be low enough to jeopardize future recruitment.

The biological assessment of the armorhead, Pseudopentaceros wheeleri, stock on Southeast Hancock Seamount was based on information obtained during research cruises conducted by the Southwest Fisheries Center Honolulu Laboratory (SWFC HL). Based on the CPUE obtained with bottom longlines, the abundance of armorhead increased in 1988 over its record low in 1987. Over the four years of the stock assessment program, however, the armorhead population has not shown the sustained increase anticipated as the result of the current fishing moratorium. Because the armorhead on Southeast Hancock Seamount probably do not comprise a discrete breeding population, and instead, form a

small part of a much larger population, we believe the protection provided by the moratorium is insufficient to rebuild the stock and some form of international management of the fisheries on all of the Emperor-Hawaiian Ridge seamounts is needed.

INTRODUCTION

In 1986, a fishery management plan (FMP) was implemented by the Western Pacific Regional Fishery Management Council (Council) for the bottomfish stocks in Hawaii, American Samoa, Guam and the Commonwealth of the Northern Mariana Islands, and for the groundfish stock on the Hancock Seamounts (WPRFMC 1986). One provision of this FMP is that every year a plan monitoring team, whose members are appointed by the Council, will prepare an annual report summarizing its assessment of the biological condition of the stocks and economic condition of the fisheries. In addition to their inclusion in the annual report, previous biological assessments of Hawaii's bottomfish stocks (Ralston and Kawamoto 1987, 1988) and seamount stocks (Somerton 1988) were also reported in separate documents to allow greater detail than in the annual report. The present document continues this precedent, but for the first time the assessments for bottomfish and seamount stocks are combined.

The biological characteristics of the bottomfish and seamount stocks and the nature and current status of their associated fisheries differ considerably. Hawaii's bottomfish stock comprises a taxonomically diverse group of fishes whose primary members are snappers, groupers and jacks (Table 1). This stock supports a commercial hook and line fishery throughout all of the Hawaiian Islands and, additionally, supports a large sport fishery in the main Islands. Most of the commercial catch is landed whole at the central wholesale market in Honolulu, where it is monitored by personnel from the SWFC HL, National Marine Fisheries Service, NOAA, to obtain information on the number and size distribution of each species. Essentially the entire stock assessment of bottomfish is based on this market sampling. By comparison, the seamount stock nearly comprises a single species, the pelagic armorhead, Pseudopentaceros wheeleri, and once supported a large foreign trawl fishery. The stock apparently could not sustain the fishery and, between 1972 and 1978, catch per unit effort (CPUE) plummeted to less than 1% of its initial level (Somerton 1988). Thus, the FMP included a moratorium on all groundfishing activities within the U.S. Exclusive Economic Zone surrounding the Hancock Seamounts. Since this moratorium precluded the use of fisheries data for stock assessment, the Honolulu Laboratory initiated a program of routine sampling cruises to the Southeast Hancock Seamount. Stock assessment of armorhead is based entirely on data collected on these cruises.

BOTTOMFISH

Methods

Approximately 50% of the Hawaiian commercial catch of bottomfish is sampled at a centralized wholesale fish market in Honolulu. The catch of each vessel is sold either as individual fish or, more commonly, in lots. A lot includes fish of only one species and has been sorted so that all individuals are approximately the same size. Since 1984, information obtained for each lot included the following: species identity, total weight (in pounds), number, vessel identification, location of capture, buyer, date of sale and price. Although the weights of the individual fish within a lot were not measured, the weight-frequency distribution of the catch can be estimated with approximately 88-99% accuracy from the mean fish weight in each lot (Ralston et al. 1986).

The biological assessments of the bottomfish stocks are based on the shapes of the weight-frequency distributions. Typically, these distributions appear dome-shaped because the number of fish landed increases with individual weight until some maximum (mode) is reached and decreases thereafter. One quantitative measure of the size of the fish harvested, the weight at entry to the fishery, was estimated as the average of the minimum and modal weight.

In previous bottomfish assessment reports (Ralston and Kawamoto 1987, 1988), the analysis of weight-frequency distributions progressed further, and various biological attributes, including growth and mortality rates, were estimated from the data. The accuracy of this type of analysis, however, depends on the validity of a variety of assumptions, especially the assumption that equilibrium conditions prevail within the fishery. After preliminary analysis of the 1988 data, it became clear that at least some of the bottomfish stocks were not in equilibrium and, instead, either showed abrupt changes in size structure or experienced large changes in catch. Since such changes can result in erroneous estimates of the biological attributes, we have chosen to avoid any misinterpretation of the data and simply present the weight-frequency histograms without further analysis. Although this approach does not provide quantitative estimates of the current fishing rates, some qualitative indication of the past fishing rates can be obtained from the shape of the size distribution. In particular, we assumed that a population composed of small fish has experienced greater fishing mortality than a population composed of large individuals of the same species.

In addition to providing some qualitative assessment of the relative fishing mortality experienced by the various stocks, we also consider the possibility of recruitment over-fishing or the

inadequate preservation of a brood stock. Ideally, we would like to estimate the size of the current spawning population, measured as a fraction of the spawning population prior to fishing, and the minimum size of the spawning population necessary for continued recruitment. Unfortunately, the available data are inadequate to estimate these quantities, and we must provide a more qualitative assessment: If a species appears to be experiencing a relatively high mortality rate and has a weight at entry less than the weight at maturity, then the possibility of recruitment over-fishing must be considered. Conversely, if a species appears to be experiencing a low mortality rate and has a weight at entry larger than the weight at maturity, then it is likely that sufficient brood stock is being preserved.

Fishing effort (trips) and CPUE (pounds per trip) were calculated for the NWHI fishery under the assumption that trips must have produced at least a 1,000-lb landing to be considered valid (Ralston and Kawamoto 1987). Since CPUE will vary among vessels, even when they are fishing side-by-side, because of differences in vessel size, fishing method, and previous experience, average CPUE will vary with the composition of the fleet. To avoid this, a time series of CPUE was developed that considered only those vessels having fished every year since 1984.

Results

Hawaii's bottomfish resource comprises 10 principal species, including seven snappers, one grouper and two jacks (Table 1). Opakapaka, Pristipomoides filamentosus, is the mainstay of the commercial fishery, accounting for 29% of the estimated catch in 1988 (Table 2). Next in importance are uku, Aprion virescens (28%), onaga, Etelis coruscans (14%) and hapuupuu, Epinephelus quernus (11%). The fishery for these species is still growing, and the estimated combined catch of all species has increased in each succeeding year between 1984 and 1988. Since the development and characteristics of the fishery in the main Hawaiian Islands (MHI) differed from that in the Northwestern Hawaiian Islands (NWHI), the two areas are considered separately in this report.

Several major changes in the general pattern of bottomfish catches occurred in 1988. First, the catch of uku in the MHI increased by more than 10 times over the 1987 catch (Table 2). Second, the catch of opakapaka increased by almost two times over the 1987 catch in the MHI, but decreased to less than half of the 1987 catch in the NWHI. The catches of hapuupuu and butaguchi, Pseudocaranx dentex, in the NWHI also both decreased in 1988 after several years of steady increase.

Catch and Effort in the NWHI

Fishing effort, measured as the number of valid trips, declined from 118 trips in 1987 to 83 trips in 1988 (Table 3). This 30% decrease continued the downward trend in effort that was first noticed in 1987. Similarly, the number of vessels participating in the NWHI fishery declined from 26 in 1987 to 14 in 1988, but the average number of trips per vessel increased from 4.5 to 5.9.

Average catch per trip (CPUE) for all vessels declined to 6,000 lb/trip in 1988 after reaching a four-year high of 7,100 lb/trip in 1987 (Table 3). This trend could be misleading, however, because the composition of the fleet has changed with time. To eliminate any bias, the time trend in CPUE was restricted to the five vessels that fished in every year. The resulting trend (Fig. 1) shows that the average catch per trip, considering either opakapaka alone or all species together, declined somewhat in 1988.

The geographical distribution of the catch among the NWHI has changed substantially since 1984 (Fig. 2). Initially the catch was obtained in the southeastern part of the NWHI, but during 1986-87, the fleet rapidly expanded operations to the northwest. During this expansion, the catch was concentrated at one or more island "hot-spots" that had never been fished before. In 1988, however, the catch was more equally distributed among islands, suggesting that most of the hot-spots had been found. Such an interpretation is consistent with the decline in CPUE observed in 1988.

Status of Individual Species

Opakapaka. In the MHI, the modal weight of opakapaka in 1988 was 2 lb, exactly the same as it was in 1987, and the overall weight-frequency distribution was essentially the same as it was in the previous 3 years (Fig. 3). In the NWHI, the condition of the opakapaka stock is quite different. The modal weight increased to 11 lb in 1988, up from 9 lb in 1987 (Fig. 4), and the overall weight-frequency distribution shows that large fish generally were more prevalent in 1988 than in the preceding four years (Fig. 4). We have no explanation for such an abrupt change in the size distribution of NWHI opakapaka after four years of relative stability; however, much of the catch was taken at Gardner Pinnacles, an area previously receiving little effort.

Regardless of this anomaly, opakapaka clearly are considerably smaller in the MHI than in the NWHI, indicating that the MHI stock has experienced greater fishing pressure. Although nothing definitive can be said about possible growth over-fishing (Ralston and Kawamoto 1987, 1988), we can make some preliminary assessments of possible recruitment over-fishing. In the MHI, the

weight at entry into the fishery (1.5 lb) is less than the weight at maturity (2.8 lb; Kikkawa 1984), and approximately 57% of the catch (in numbers) is composed of immature fish. This indicates the spawning stock is likely to be small and the continued increase in catch may jeopardize future recruitment. In the NWHI, however, the weight at entry of opakapaka (6.5 lb) is considerably larger than the weight at maturity, and only 1% of the catch (in numbers) is immature. This indicates there is presently little danger of recruitment over-fishing.

Onaga. In the MHI, the modal weight of onaga was 2 lb in 1988, exactly the same as in 1987, and the overall weight-frequency distribution was essentially the same as in the preceding three years (Fig. 5). In the NWHI, the modal weight of onaga was 12 lb in 1988, down from 14 lb in 1987. However, both the 1987 and 1988 weight-frequency histograms are bimodal, which is unusual, and the decrease in modal weight is likely unrelated to changes in fishing mortality (Fig. 6). This view is supported by the overall weight-frequency distribution in 1988, which included fewer large fish than in 1987 but about the same number as the preceding two years. Again, the smaller sizes of onaga in the MHI indicates that the stock has experienced greater fishing pressure than in the NWHI.

In terms of potential recruitment over-fishing, the situation is similar to opakapaka. In the MHI, the weight at entry to the fishery (1.5 lb) is much less than the weight at maturity (9.9 lb; Everson et al. in press), and approximately 82% of the catch (in numbers) is composed of immature fish. This suggests that recruitment over-fishing is possible, even at the current level of fishing. In the NWHI, the weight at entry (6.5 lb) is less than the size at maturity, and 47% of the catch (in numbers) is immature. Regardless of the sizable catch of immature fish, the likelihood of recruitment over-fishing is less in the NWHI than in the MHI, because the fishing pressure experienced by the NWHI stock appears to be less.

Ehu. In the MHI, the modal weight of ehu in 1988 was 1 lb, the same as in 1987, and the overall weight-frequency distribution was essentially the same as in the previous 4 years (Fig. 7). In the NWHI, the modal weight was 3 lb in 1988, the same as in 1987, and the overall weight-frequency distribution was essentially the same as in the preceding three years (Fig. 8). As with onaga, the size of ehu in the NWHI is considerably larger than in the MHI, and this difference reflects the difference in fishing pressure between areas.

In terms of potential recruitment over-fishing, the situation is also similar to that of onaga. In the MHI, the weight at entry (0.5 lb) is considerably smaller than the weight at maturity (1.6 lb; Everson 1984), and 90% of the catch (in numbers) is composed of immature fish. In the NWHI, the weight

at entry (1.5 lb) is nearly equal to the weight at maturity, and 38% of the catch (in numbers) is immature. This indicates recruitment over-fishing is possible at the current level of fishing effort in the MHI but unlikely in the NWHI.

Uku. In the MHI, the modal weight of uku was 6 lb in 1988, exactly the same as in 1987, and the overall weight-frequency distribution was also nearly the same as in 1987 (Fig. 9). The weight-frequency distributions for 1987 and 1988, however, include more smaller fish than in previous years and suggest that a large recruitment of small fish occurred in 1987. It is not clear, however, if the ten-fold increase in uku catch from 1987 to 1988 was due to this recruitment or to some change in the availability of uku.

In terms of potential recruitment over-fishing, the weight at entry (3.5 lb) is slightly greater than the weight at maturity (3.3 lb; Everson et al. in press), but only 4% of the catch (in numbers) is immature. This indicates that, at present, the likelihood for recruitment over-fishing is presently small.

Hapuupuu. In the MHI, the modal weight of hapuupuu in 1988 was 8 lb, exactly the same as in 1987, and the overall weight-frequency distribution was essentially the same as it was in the preceding 5 years (Fig. 10). In the NWHI, the modal weight of hapuupuu in 1988 was 10 lb, increasing greatly from 4 lb in 1987, and the overall weight-frequency distribution shows that intermediate to large fish were generally more prevalent in the 1988 catch than in the previous four years (Fig. 11). This change probably reflects a change in the fishing strategy of the fleet rather than a change in the stock. Catches of hapuupuu are incidental to catches of opakapaka, ehu and onaga. In recent years, the NWHI catch of opakapaka greatly exceeded the catch of ehu and onaga, but in 1988, the opakapaka catch dropped to less than one-half of its 1987 level and the catches of ehu and onaga both increased in an apparent attempt by fishermen to make up the shortfall. Since ehu and onaga occur in deeper water than opakapaka, such a shift in species composition probably indicates a shift in fishing depth. Since hapuupuu occur in progressively deeper water as they grow (Ralston 1981), a shift in fishing depth would probably result in a shift in the size of hapuupuu that are incidentally caught.

The weight at maturity of hapuupuu is unknown; therefore, at present, we have no indication of the likelihood of recruitment over-fishing.

Butaguchi. In the NWHI, the modal weight of butaguchi was 14 lb in 1988, exactly the same as in 1987, and the overall weight-frequency distribution is similar to that in 1987 (Fig. 12). This apparent stability of the weight-frequency distribution is recent, however, and the distributions have

fluctuated widely over the previous 4 years. Like hapuupuu, butaguchi tend to occur in deeper water as they grow (Ralston 1981), and shifts in the size distribution could reflect differences in fishing depth rather than changes in the population. Unlike hapuupuu, however, a sizable fraction of the catch is probably obtained with directed fishing effort rather than caught incidental to other species. In the MHI, the fishery for butaguchi is insignificant and has been omitted here.

Like hapuupuu, the weight at maturity of butaguchi is unknown, and no assessment of the likelihood of recruitment over-fishing can be made.

White ulua. In the MHI, the modal weight of ulua was 2 lb in 1988, exactly the same as in 1987, but the overall weight-frequency distribution indicates that there were slightly more fish at intermediate sizes in 1988 than in previous years (Fig. 13). In the NWHI, the modal size was 36 lb in 1988, exactly the same as in 1987, but the overall weight-frequency distribution again indicates that there were substantially more large fish in 1988 than in previous years (Fig. 14). The reasons for the extreme variability in the NWHI size distributions among years is unknown.

In terms of potential recruitment over-fishing, the situation is similar to opakapaka, onaga and ehu. In the MHI, the weight at entry (4.0 lb) is much smaller than the size of maturity (7.0 lb; Sudekum et al. in prep.), and 67%, by numbers, of the catch was immature. In the NWHI, however, the weight at entry (22.0 lb) was much larger than the weight at maturity and 0% of the catch was immature. In the MHI, recruitment over-fishing is possible at the current level of fishing effort, but in the NWHI, it is unlikely even with a substantial increase in fishing effort.

Incidental species. Kalekale, Pristipomoides sieboldii; gindai, P. zonatus; and lehi, Aphareus rutilans, are minor components of the bottomfish catch and are caught incidentally to other species. Because of this, we simply summarized the weight-frequency distributions over 1984-88 in the MHI and the NWHI for the first two species and in the MHI alone for the last. Kalekale and gindai show similar patterns in that the size distribution within each area has remained fairly constant over time, but fish from the NWHI are generally larger than those from the MHI (Fig. 15). Lehi, which are abundant only in the MHI, display considerable variability in size among years, but fish sampled in 1988 are clearly larger than those sampled in preceding years (Fig. 15). The weight at maturity is unknown for all three of these species.

Discussion

The condition of the various stocks differs considerably between the NWHI and the MHI. In the NWHI, there is little to suggest that the fishery is stressed. Opakapaka, the traditional mainstay of the NWHI fishery, is apparently decreasing in abundance, and fishers are compensating for this by spreading their effort more equitably among the islands and by increasing effort directed toward onaga and ehu. Decreases in opakapaka catch and CPUE probably reflect the fishers' decreasing ability to find undiscovered opakapaka hot-spots. Such a pattern is normal during the early stages of a developing fishery and, from a purely biological perspective, should not be viewed with alarm. In terms of reproductive potential, all species examined, except onaga, have a weight at entry larger than the weight at maturity and are therefore unlikely to experience recruitment over-fishing unless there are substantial increases in fishing pressure. One caveat, however, is that the estimated weight at entry can be too large if the geographical distribution of the catch is not in equilibrium with the stock, that is, if the catch is concentrated in areas that have received little previous fishing effort. Such disequilibrium has existed in the NWHI since the fishery started, but judging from the recent changes in the geographical distribution of the catch, it appears that equilibrium conditions will soon be achieved.

In the MHI, several stocks are clearly stressed. Although catches of the deeper species (ehu, onaga and kalekale) declined in 1988, catches of shallow species continued to show an increasing trend (Table 2). Most of these changes, however, do not reflect changes in the conditions of the various stocks but are instead probably related to an apparent change in the fishing pattern of the bottomfish fleet during 1988. For example, in response to the huge increase in uku abundance, fishers may have made more bottomfish fishing trips and shifted effort from deep water to shallower areas inhabited by uku. Since opakapaka is caught incidentally by fishers targeting uku, the large increase in the opakapaka catch was likely due to the increase in uku effort rather than to any change in opakapaka abundance. In terms of reproductive potential, four species (opakapaka, ehu, onaga and white ulua) are being harvested at such small sizes that the catch is primarily composed of juveniles. This, coupled with the probable, high fishing pressure, suggests that the spawning stock is likely to be quite low, perhaps sufficiently low to influence future recruitment.

In the last bottomfish stock assessment report, Ralston and Kawamoto (1988) recognized the stressed condition of these stocks and suggested increasing the minimum commercial size above the current 1-lb limit as a remedy. In response, the State of Hawaii's Department of Land and Natural Resources proposed that a 3-lb minimum size limit would be appropriate for opakapaka, onaga

and white ulua, and 1-lb for ehu. Such a minimum size would be effective only to the extent that undersized fish are no longer killed by the fishery. Since opakapaka and onaga live in relatively deep water, few would survive capture and release; the success of an increased minimum size limit depends, therefore, on the ability of fishers to avoid catching small fish. We are now beginning research on the targetability of small opakapaka and anticipate at least preliminary results in the next stock assessment report.

ARMORHEAD

Methods

Armorhead stock assessment is based on longline catches obtained by SWFC HL personnel during research cruises to the Southeast Hancock Seamount. Eight stock assessment cruises have occurred since 1985; the inclusive dates and the sampling effort, expressed as the number of hooks set, are shown for each cruise in Table 4. The fishing gear and sampling methods are described in Somerton (1988) and Somerton and Kikkawa (in prep.).

Two types of information are obtained from the longline catches: relative abundance (CPUE) and fatness index (FI). A detailed description of the methods used for estimating these two quantities is provided in Somerton and Kikkawa (in prep.), but the major features are as follows. The estimate of CPUE, expressed as the catch per 1,000 hooks, was a depth-stratified average corrected for the presence of hook timers (Somerton et al. 1988). Previous estimates of armorhead CPUE (Somerton 1988) were calculated by using four depth strata. In this report, we also use four depth strata, but the depth boundary between the first (shallowest) and second strata was changed to better reflect the distribution of armorhead. Since the change in boundaries changes the estimates of CPUE, all previous estimates were recalculated by using the new boundary definitions. The estimate of FI, calculated as body depth divided by fork length, was used as an index of residence time, that is, the time between sampling and when an armorhead first arrived at the seamount. Because armorhead arrival apparently occurs over relatively short time intervals, frequency histograms of FI tend to display modes representing cohorts of fish. These modes were tracked through the time series of FI frequency distributions to verify patterns of recruitment indicated by changes in CPUE.

In 1988, Honolulu Laboratory personnel conducted an exploratory research cruise that surveyed three of the Emperor Seamounts (Colahan, Kammu and Koko Seamounts) in addition to the Southeast Hancock Seamount (Table 4). Armorhead were sampled with longlines by using the same techniques as the normal stock assessment cruises, but without the hook timers. Estimates of

average CPUE were not stratified by depth because the depth variation on the northern seamounts is imprecisely known.

Results

Armorhead CPUE on Southeast Hancock Seamount fluctuated from a high in August 1986 to a low in August 1987, then increased again in August 1988 (Fig. 16). Since no commercial fishing occurred during this period, the fluctuations apparently were due to episodic recruitment, followed by high natural mortality. The episodic pattern of recruitment can be seen in the time series of FI frequency distributions (Fig. 17). Since fish with a FI's of relative abundance of such fish indicated periods of recruitment. Over the 4-year series, the relative abundance of fat fish increased twice, once between June 1985 and August 1986 and again between August 1987 and August 1988. Both of these periods of recruitment coincided with the periods of rapid increases in CPUE.

Some information on the pattern of recruitment that occurred prior to the stock assessment cruises can be obtained by using the average rate of decrease of FI (-0.002 per month) to estimate when a cohort arrived at the seamount. When this technique was applied to the earliest cohort in the time series, that is, the major mode observed in January 1985 (FI = 0.221), it indicated that recruitment probably occurred in 1982. Since no other cohorts were represented in the FI frequency distributions until August 1986, it appears that relatively large recruitment episodes have occurred only three times since 1982.

Armorhead CPUE on each of the three Emperor Seamounts was 31.4 at Colahan, 7.1 at Kammu, and 14.3 at Koko, all considerably lower than on the Southeast Hancock Seamount (depth-stratified mean, 147.0; non-stratified mean, 298.3). Although the sample sizes are small, the FI frequency distributions for Colahan and Kammu Seamounts both have had near the FI of recruiting fish (Fig. 18) and, like the Southeast Hancock Seamount, appeared to have received some recruitment during 1988. However, there was no indication that Koko Seamount received any recruitment. Koko Seamount was also anomalous in that the armorhead were considerably larger there than on the other seamounts (Fig. 18).

Discussion

Fishing has not occurred on the Southeast Hancock Seamount for five years, yet the population has not shown a sustained increase. There are at least two reasons for this. First, armorhead recruitment appears to be quite variable not only in magnitude but also in frequency. Over the last 8 years, apparently only three recognizable recruitment episodes occurred, and in no case did the episodes follow each other in consecutive years. It is not clear if this sporadic pattern of recruitment

is a usual feature of armorhead population dynamics or if it is related to the extremely low population level that currently exists. Its effect, however, is that even when relatively good recruitment does occur, as it did in 1986, a high population level does not persist for long because the natural mortality of armorhead is also high (ca. 50% per year).

A second reason why armorhead abundance has not shown a sustained increase is that the fish on the Southeast Hancock seamount probably do not comprise a discrete spawning population and their progeny are equally likely to recruit to any of the Emperor or Hawaiian Ridge seamounts. The question of stock unity was examined in the last report (Somerton 1988), and there is no new evidence to contradict the hypothesis that all North Pacific armorhead belong to the same population. This is further supported by the apparent, recent recruitment to Colahan and Kammu Seamounts which, based on the modal values of FI, appears to have occurred at the same time as the recruitment to the Southeast Hancock Seamount. Research on the population structure of armorhead is continuing, and during the 1988 exploratory cruise, tissue samples from several seamounts were collected and used for mitochondrial DNA analysis, a new technique for stock separation.

Although the Southeast Hancock Seamount population does not show a sustained increase, the moratorium on commercial fishing clearly provides some protection because the CPUE on the Southeast Hancock Seamount is 5-20 times higher than on the Emperor Seamounts. This difference in CPUE probably reflects a difference in fishing pressure between areas, but we are uncertain about the exact level of effort being expended on the Emperor Seamounts and only have fragmentary and anecdotal information. For example, during the 1988 survey, several foreign vessels (one Japanese, others probably Taiwanese) were observed on Kammu and Koko Seamounts, supposedly fishing for alfonsin, Beryx splendens, with gill nets in deeper water. A brief conversation with the captain of one of these vessels revealed that the armorhead catch rates were so low that trawlers were no longer fishing the Emperor Seamounts. Regardless, of the current level of fishing activity, various nations certainly have the capacity to fish the seamounts if it is profitable, and this would quickly reduce the population. Thus, the current fishing moratorium on the Hancock Seamounts appears to have preserved a brood stock, but this brood stock may be insufficient to allow significant population growth to occur either on the Southeast Hancock Seamount or the entire group of seamounts that once supported the fisheries. To change this situation, that some form of international management of the seamount resources clearly is needed.

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REFERENCES

Everson, A.R. 1984. Spawning and gonadal maturation of the ehu, Etelis carbunculus, in the Northwestern Hawaiian Islands. In: R.W. Grigg and K.Y. Tanoue (eds.), Proceedings of the Second Symposium on Resource Investigations in the Northwestern Hawaiian Islands, Vol. 2, May 25-27, 1983, University of Hawaii, Honolulu, Hawaii, p. 128-148. UNIHI-SEAGRANT-MR-84-01.

Everson, A.R., H.A. Williams and B. Ito. In press. Maturation and reproduction in two Hawaiian eteline snappers: uku, Aprion virescens, and onaga, Etelis coruscans. Fish. Bull.

Kikkawa, B.S. 1984. Maturation, spawning, and fecundity of opakapaka, Pristipomoides filamentosus, in the Northwestern Hawaiian islands. In: R.W. Grigg and K.Y. Tanoue (eds.), Proceedings of the Second Symposium on Resource Investigations in the Northwestern Hawaiian Islands, Vol. 2, May 25-27, 1983, University of Hawaii, Honolulu, Hawaii, p. 149-160. UNIHI-SEAGRANT-MR-84-01.

Ralston, S. 1981. A study of the Hawaiian deep-sea handline fishery with special reference to the population dynamics of opakapaka, Pristipomoides filamentosus (Pisces: Lutjanidae). Ph.D. Thesis, Univ. Wash., Seattle, WA. 204 p.

Ralston, S. and K.E. Kawamoto. 1987. An assessment and description of the status of bottom fish stocks in Hawaii. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-87-7. 55 p.

----------. 1988. A biological assessment of Hawaiian bottom fish stocks, 1984-1987. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Rep. H-88-8. 60 p.

Ralston, S., D.T. Tagami and P.M. Shiota. 1986. An analysis of bottom fish size variation at the Honolulu fish auction. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-86-10. 11 p.

Somerton, D.A. 1988. Assessment of the stock condition of pelagic armorhead on Southeast Hancock Seamount. Southwest Fish. Cent. Honolulu Lab. Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-88-9. 7 p.

Somerton, D.A. In prep. A method of stock assessment using time-to-capture of individual fish on a longline and its application to Pelagic armorhead, Pseudopentaceros wheeleri, on the Hancock Seamount.

Somerton, D.A. and B.S. Kikkawa. In prep. Contribution to the life history of pelagic armorhead, Pseudopentaceros wheeleri, on the Southeast Hancock Seamount.

Somerton, D.A., B.S. Kikkawa and C.D. Wilson. 1988. Hook timers to measure the capture time of individual fish. Mar. Fish. Rev. 50(2): 1-5.

Sudekum, A.E., J.D. Parrish, R.L. Radtke and S. Ralston. In prep. Life history and trophic ecology of two large jacks in the Northwestern Hawaiian Islands. Hawaii Coop. Fish. Res. Unit, Univ. Hawaii, Honolulu, HI 96822.

Western Pacific Regional Fishery Management Council. 1986. Combined fishery management plan, environmental assessment and regulatory impact review for the bottomfish and seamount groundfish fisheries of the western Pacific region. Western Pacific Regional Fishery Management Council, 1164 Bishop Street, Honolulu, HI 96813-2586. Var. pag.

APPENDIX A: TABLES

Table 1. Common and scientific names of Hawaiian bottomfish.

Lehi	Aphareus rutilans
Uku	Aprion virescens
Ehu	Etelis carbunculus
Onaga	Etelis coruscans
Opakapaka	Pristipomoides filamentosus
Kalekale	Pristipomoides sieboldii
Gindai	Pristipomoides zonatus
Hapuupuu	Epinephelus quernus
White ulua	Caranx ignobilis
Butaguchi	Pseudocaranx dentex

Table 2. Landings of principal bottomfish species from the main Hawaiian Islands (MHI) and Northwestern Hawaiian Islands (NWHI), 1984-88.

Species	Region	Catch (metric tons) 1984	1985	1986	1987	1988
Lehi	MHI	5.4	7.4	4.8	10.3	20.2
	NWHI	0.01	0.0	0.0	0.0	0.03
Uku	MHI	62.2	16.2	41.8	25.0	281.8
	NWHI	3.4	0.7	3.1	1.6	3.5
Ehu	MHI	13.0	25.8	23.8	30.2	21.2
	NWHI	2.2	9.3	12.5	18.0	20.3
Onaga	MHI	73.4	128.6	116.2	144.7	102.7
	NWHI	3.1	23.3	43.6	28.9	36.3
Opakapaka	MHI	75.0	61.8	73.0	138.0	215.3
	NWHI	143.4	140.5	122.6	165.3	69.5
Kalekale	MHI	8.8	13.8	11.2	18.2	8.2
	NWHI	1.3	2.9	2.8	1.9	1.0
Gindai	MHI	1.2	1.6	1.8	1.2	2.2
	NWHI	1.3	2.7	3.4	3.8	1.6
Hapuupuu	MHI	13.4	6.8	7.2	9.1	11.5
	NWHI	46.1	66.8	86.6	99.8	70.3
White ulua	MHI	17.4	14.4	13.8	9.1	37.7
	NWHI	12.0	27.7	13.4	25.3	27.5
Butaguchi	MHI	1.6	0.8	1.2	2.9	7.9
	NWHI	29.5	56.2	66.1	97.0	50.0
Area Total	MHI	271.6	277.2	295.0	389.6	707.6
	NWHI	242.4	330.1	354.1	441.6	280.0
Grand Total		514.0	607.3	649.1	831.2	987.6

Table 3. Effective effort (number of 1000-lb trips) and catch per unit effort (CPUE x 1000) (lb bottomfish per trip) for the Northwestern Hawaiian Islands bottomfish fishery from 1984-1988.

	1984		1985		1986		1987		1988	
Vessel	Trips	CPUE	Trips	CPUE	Trips	CPUE	Trips	CPUE	Trips	CPUE
A	2	6.1	--	--	--	--	--	--	--	--
B	1	1.0	--	--	--	--	--	--	--	--
C	7	2.6	--	--	--	--	--	--	--	--
D	10	10.6	--	--	--	--	1	--	--	--
E	2	2.7	--	--	--	--	1	2.3	--	--
F	4	1.3	1	2.1	--	--	--	--	--	--
G	4	3.4	3	4.1	--	--	--	--	--	--
H	8	4.0	6	3.2	--	--	--	--	--	--
I	3	1.8	4	1.6	1	1.2	--	--	--	--
J	5	4.0	11	4.3	8	4.3	11	5.6	9	4.6
K	12	8.4	13	8.2	11	6.1	4	7.2	--	--
L	12	4.7	5	3.5	2	3.4	3	4.3	3	2.0
M	6	5.1	10	5.6	8	3.3	7	4.8	--	--
N	3	4.5	3	3.0	4	5.0	5	5.2	--	--
O	10	3.1	15	4.2	11	4.0	11	5.8	14	5.1
P	5	3.7	4	3.3	13	4.7	3	7.5	--	--
Q	4	3.2	16	5.8	15	5.5	16	9.4	13	8.0
R	9	3.6	5	3.2	8	6.3	6	5.0	3	4.8
S	--	--	4	6.9	5	7.3	3	9.8	--	--
T	--	--	1	3.3	9	8.3	6	13.6	7	8.6
U	--	--	1	4.0	3	1.2	2	5.3	--	--
V	--	--	1	2.3	2	1.2	3	6.9	--	--
W	--	--	11	8.8	11	11.1	11	12.0	7	16.7
X	--	--	13	7.3	7	6.1	2	6.7	1	4.7
Y	--	--	6	1.6	6	1.9	--	--	--	--
Z	--	--	1	5.5	--	--	1	4.5	--	--
AA	--	--	--	--	3	11.1	3	14.3	--	--
BB	--	--	--	--	1	1.2	2	3.6	--	--
CC	--	--	--	--	3	3.7	2	5.9	--	--
DD	--	--	--	--	7	1.5	2	1.6	9	2.1
EE	--	--	--	--	1	6.5	--	--	--	--
FF	--	--	--	--	--	--	3	3.4	--	--
GG	--	--	--	--	--	--	3	1.7	6	3.3
HH	--	--	--	--	--	--	3	3.0	--	--
II	--	--	--	--	--	--	4	5.5	--	--
JJ	--	--	--	--	--	--	--	--	2	2.1
KK	--	--	--	--	--	--	--	--	1	1.9
LL	--	--	--	--	--	--	--	--	5	5.4
MM	--	--	--	--	--	--	--	--	3	2.4
Ave. CPUE	--	4.8	--	5.3	--	5.4	--	7.1	--	6.0
Total Trips	107	--	134	--	139	--	118	--	83	--

Table 4. Inclusive dates and sample sizes, expressed as number of longline hooks set, for the eight stock assessment cruises to Southeast (SE) Hancock Seamount and the one research cruise to the Emperor Seamounts.

Dates	Seamount	Hooks
02/02/85 - 02/26/85	SE Hancock	2,016
06/20/85 - 07/15/85	SE Hancock	2,718
08/11/86 - 09/08/86	SE Hancock	6,711
10/31/86 - 11/11/86	SE Hancock	2,948
03/12/87 - 03/27/87	SE Hancock	3,636
08/16/87 - 08/24/87	SE Hancock	4,534
01/13/88 - 01/29/88	SE Hancock	3,538
07/13/88 - 07/25/88	SE Hancock	4,185
07/31/88 - 08/21/88	Colahan	1,562
"	Kammu	3,109
"	Koko	5,482
"	SE Hancock	2,319

APPENDIX B: FIGURES

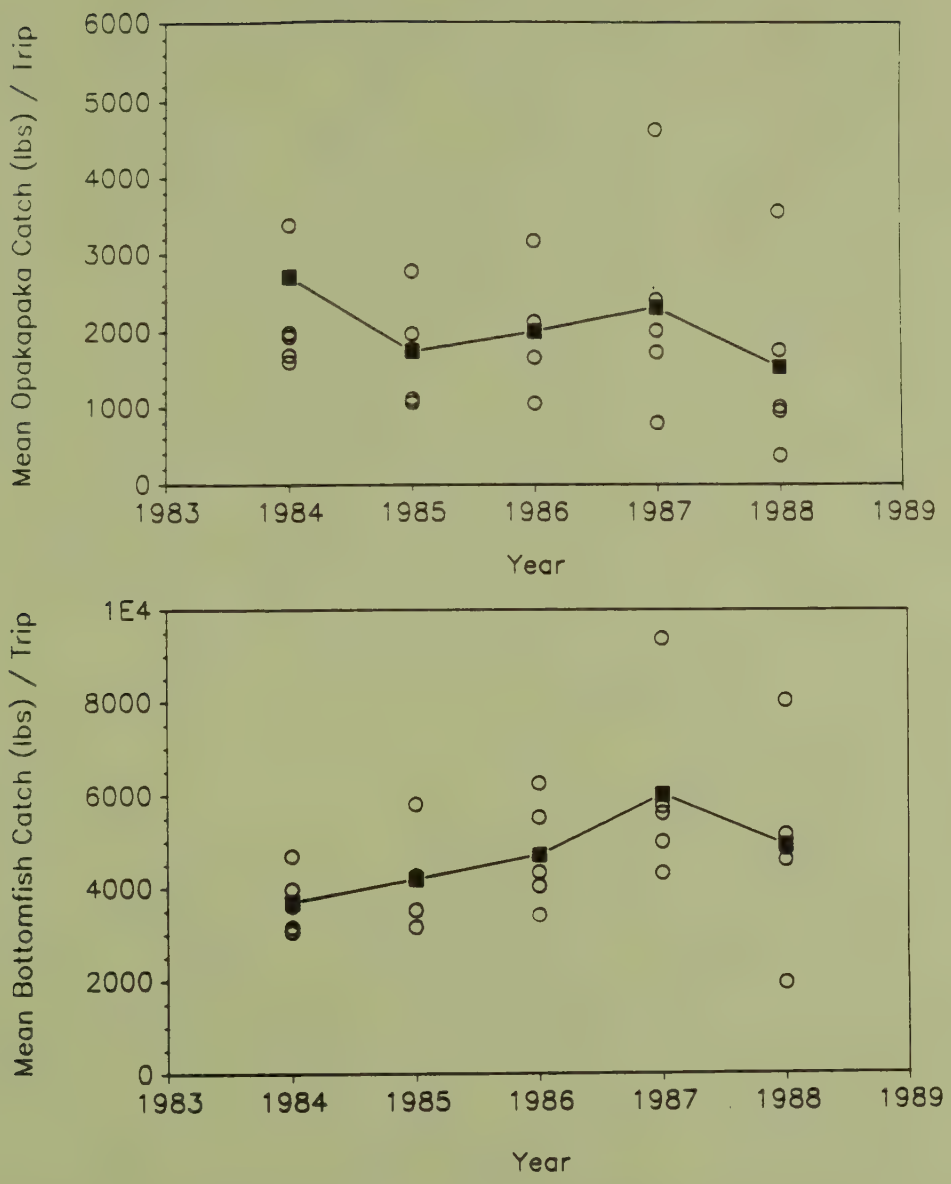
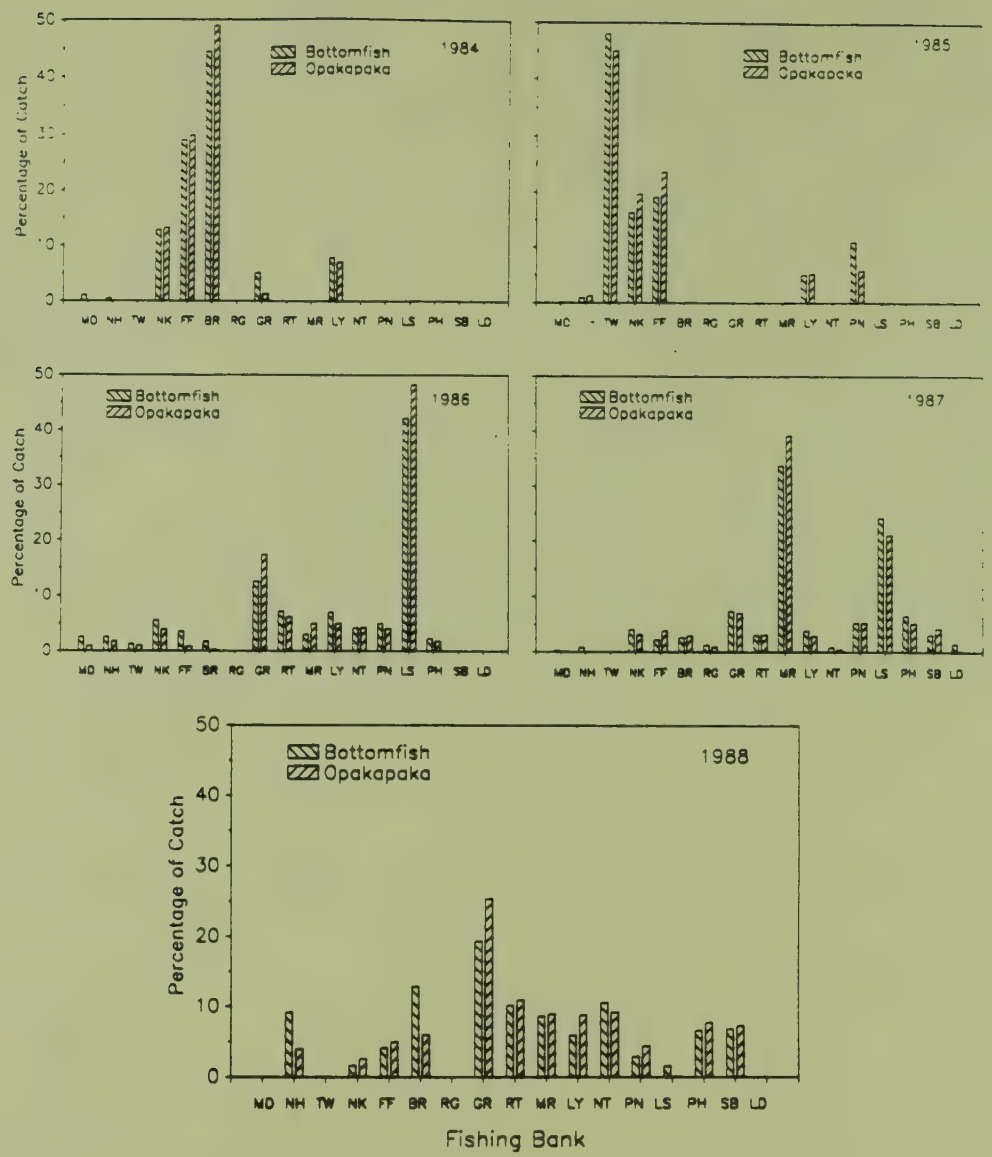


Figure 1. Catch rate statistics for opakapaka (top) and all bottomfish (bottom) for the five vessels active in the Northwestern Hawaiian Islands during the 1984-88 period. Open circles = annual mean catch rates for individual vessels; closed squares = the yearly group means.



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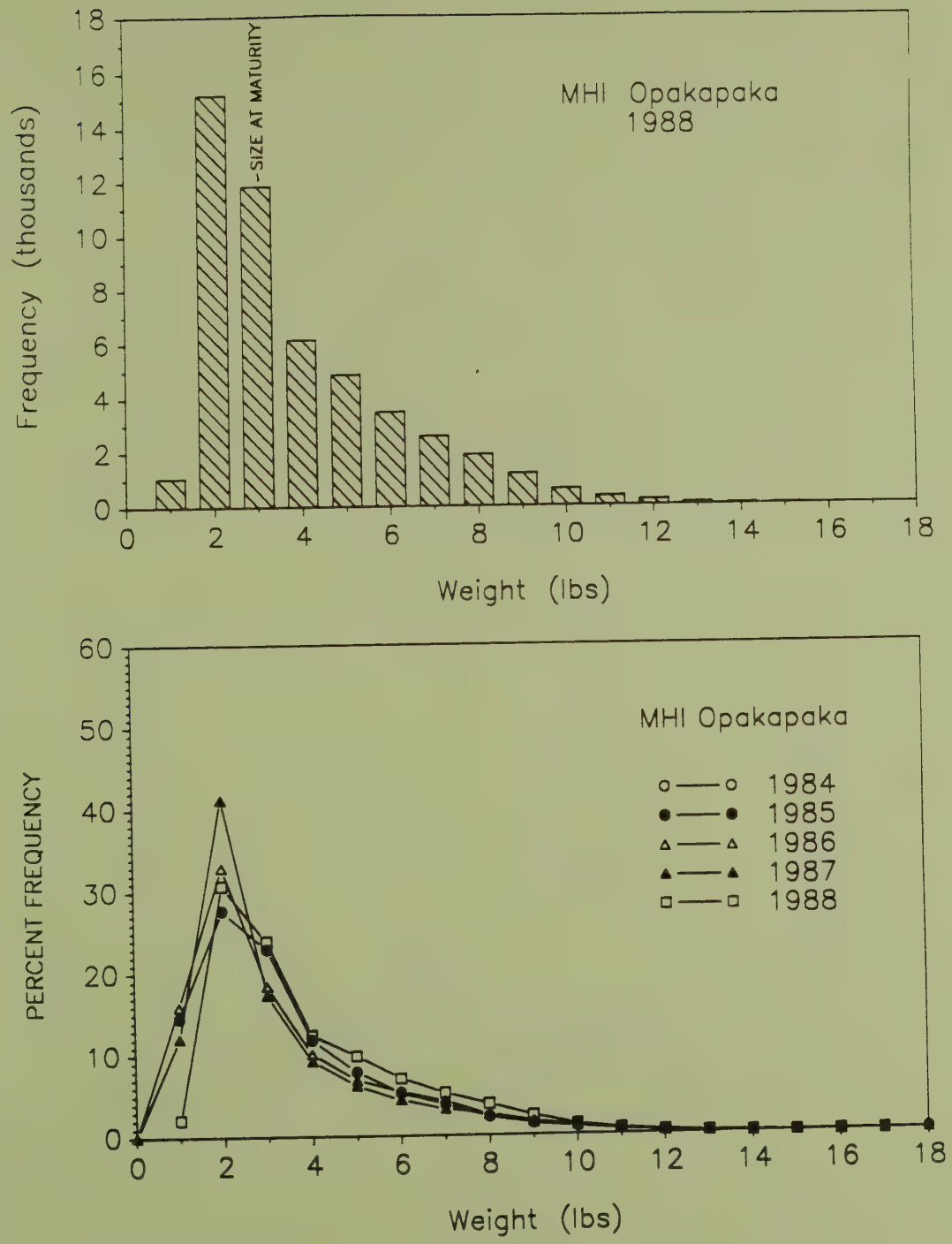


Figure 3. Opakapaka: Weight-frequency distribution from main Hawaiian Islands (MHI), based on market samples in 1988 (top) and in 1984-88 (bottom).

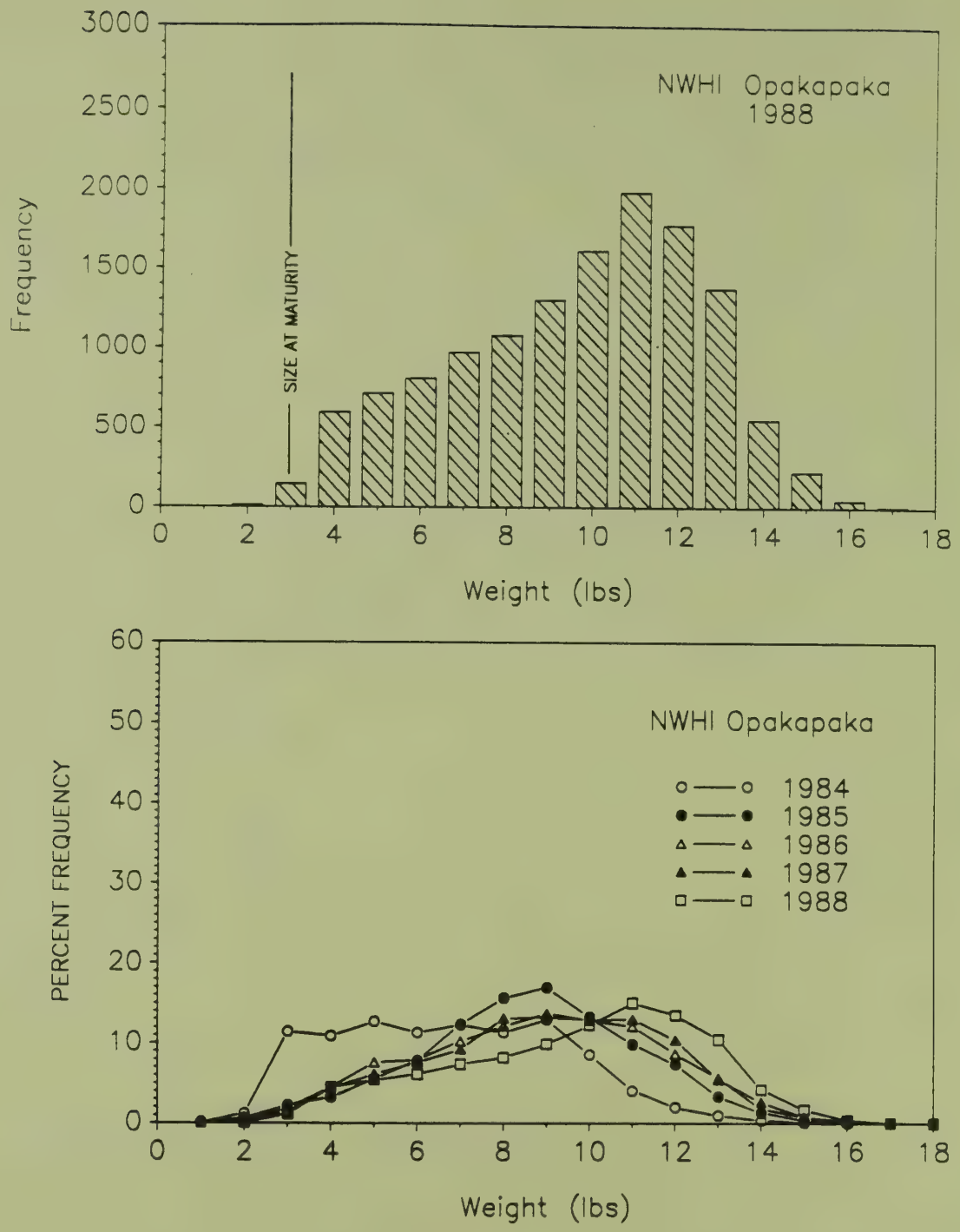
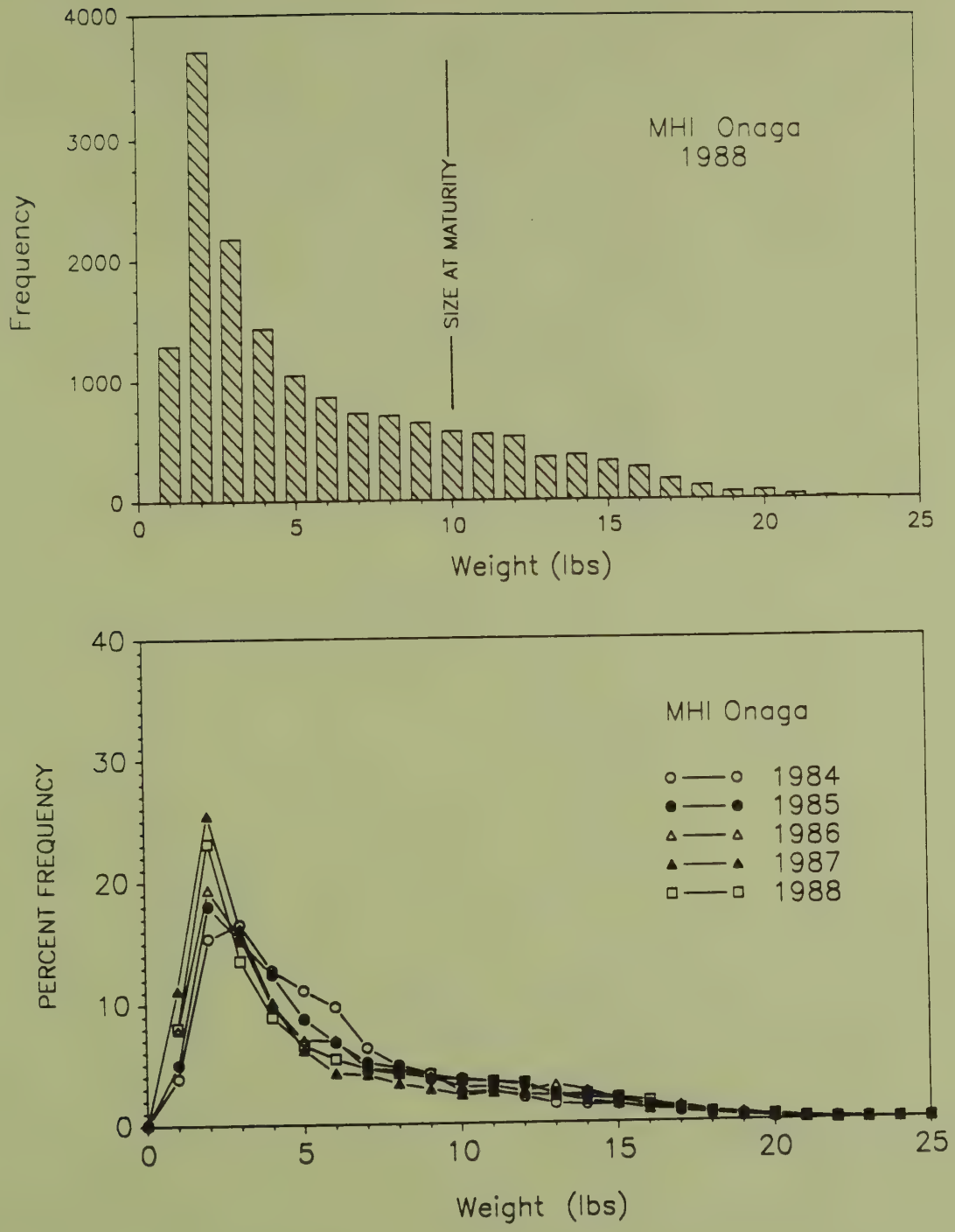


Figure 4. Opakapaka: Weight-frequency distributions from Northwestern Hawaiian Islands (NWHI), based on market samples in 1988 (top) and in 1984-88 (bottom).



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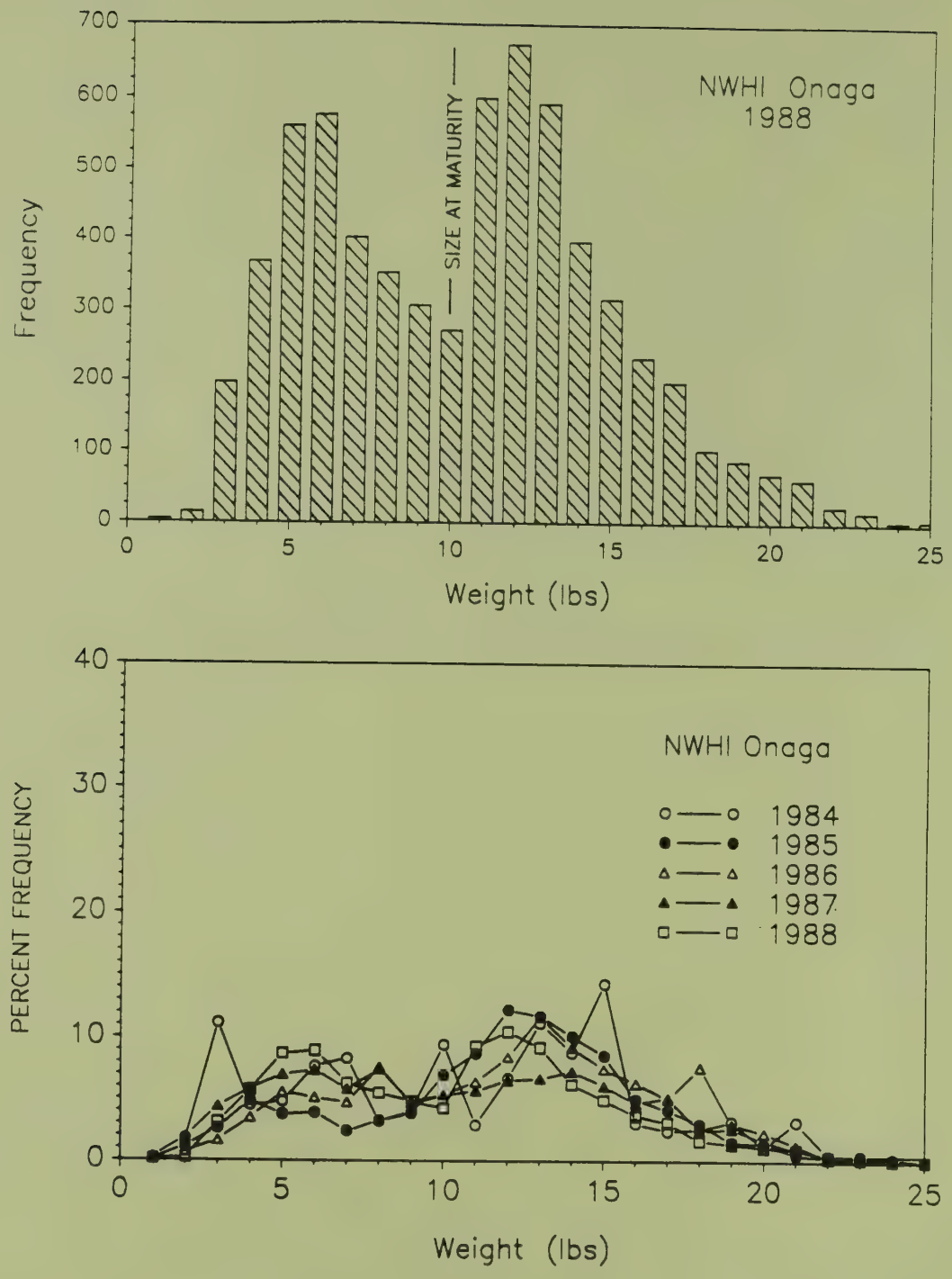
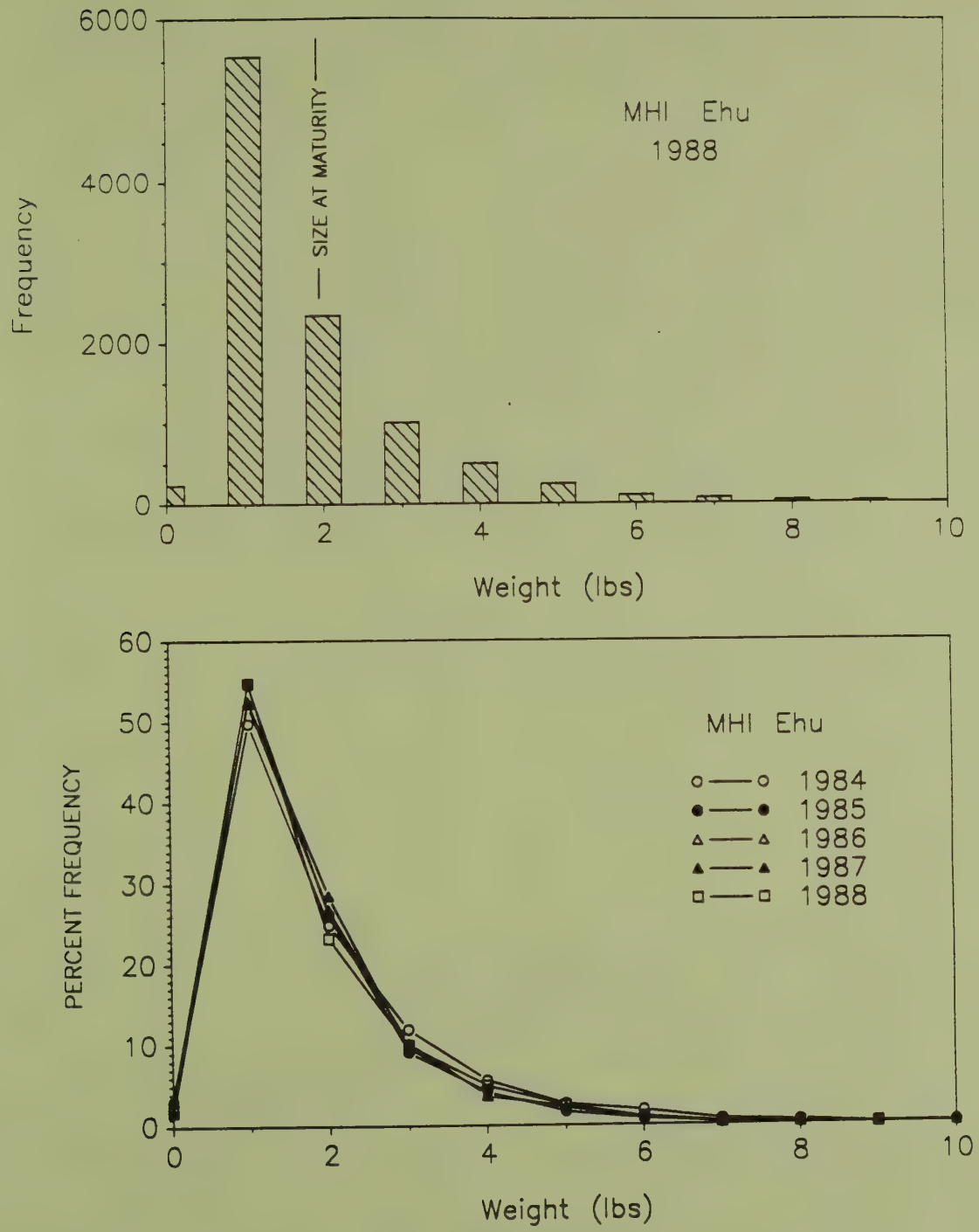


Figure 6. Onaga: Weight-frequency distributions from Northwestern Hawaiian Islands (NWHI), based on market samples in 1988 (top) and in 1984-88 (bottom).



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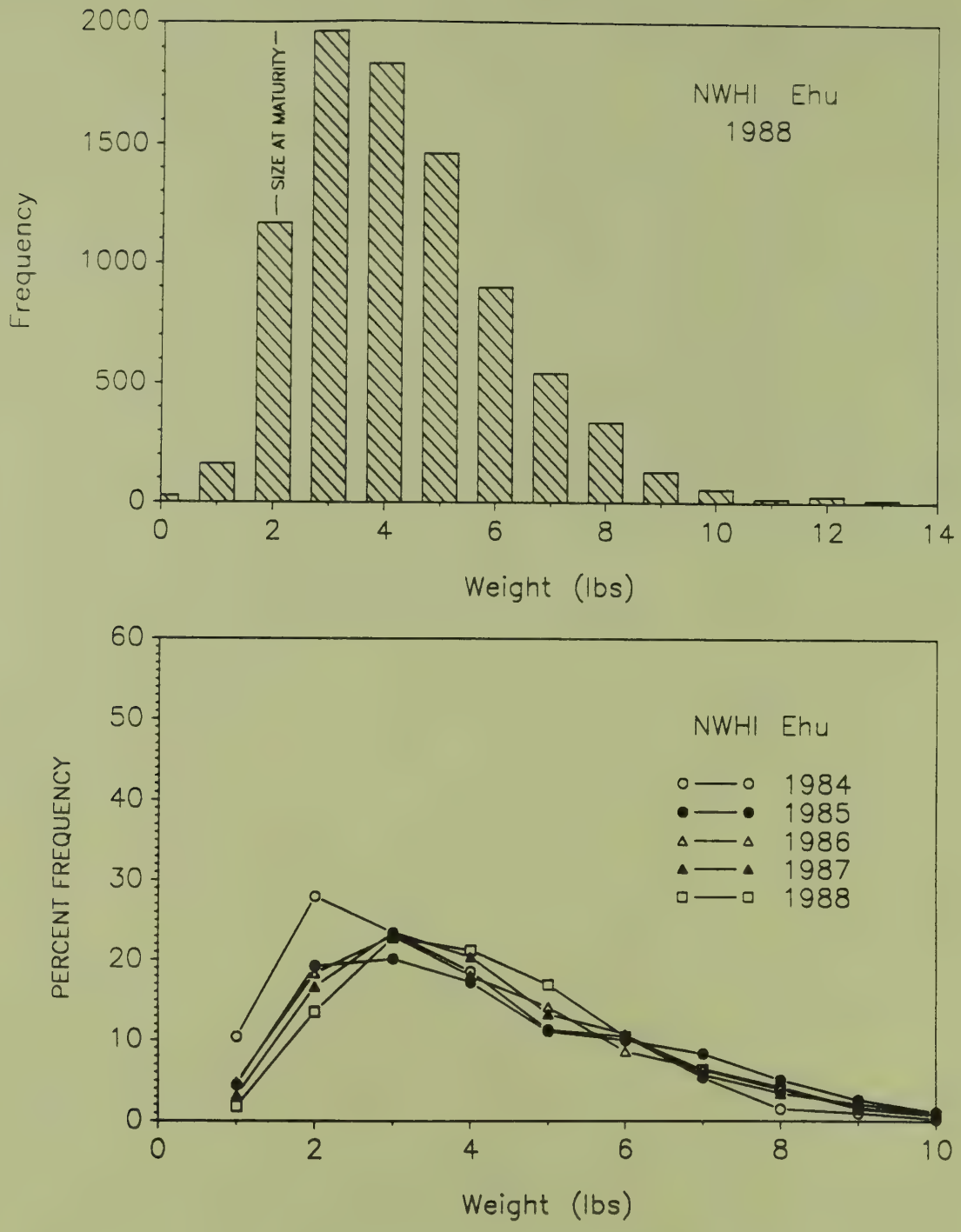
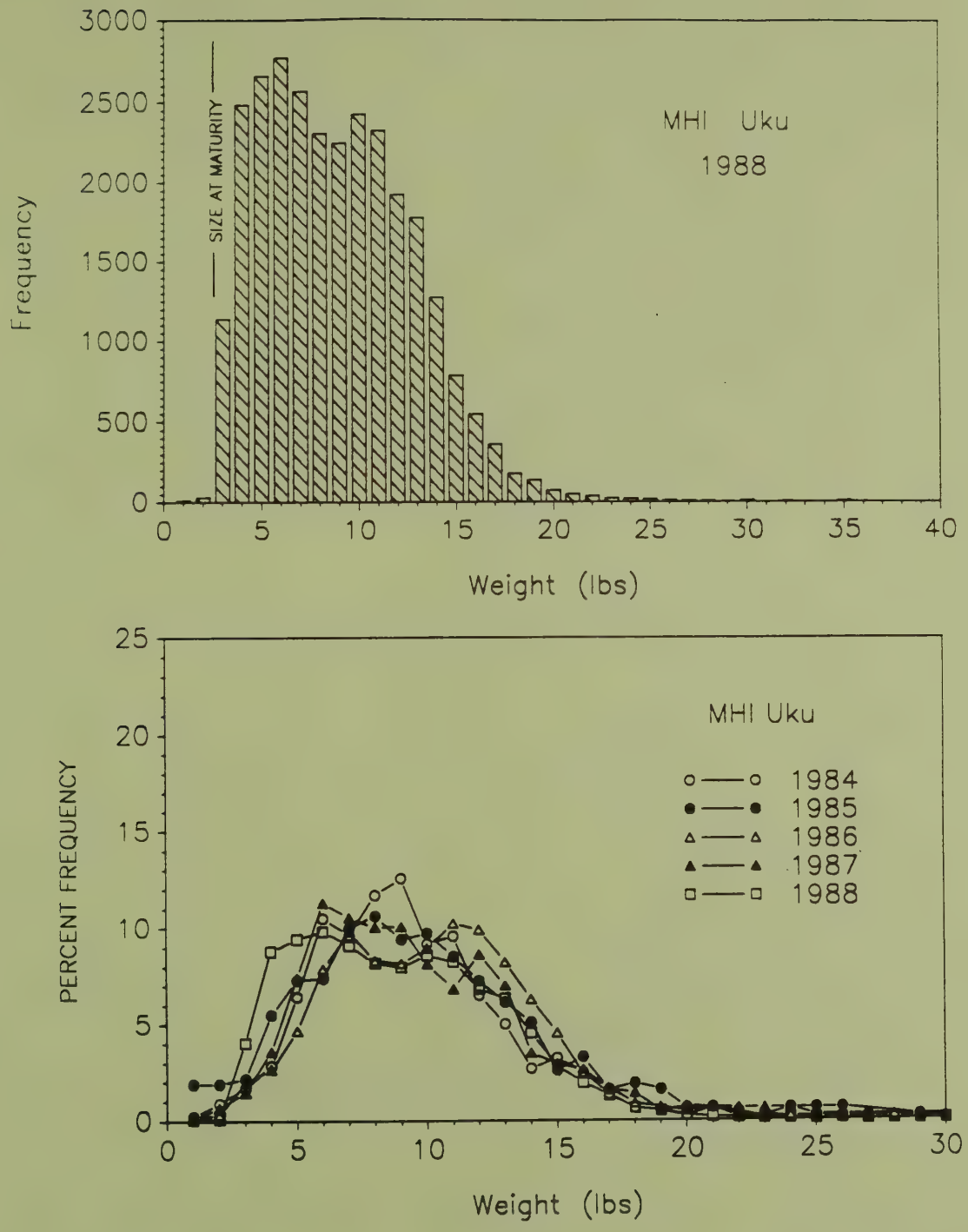


Figure 8. Ehu: Weight-frequency distributions from Northwestern Hawaiian Islands (NWHI), based on market samples in 1988 (top) and in 1984-88 (bottom).



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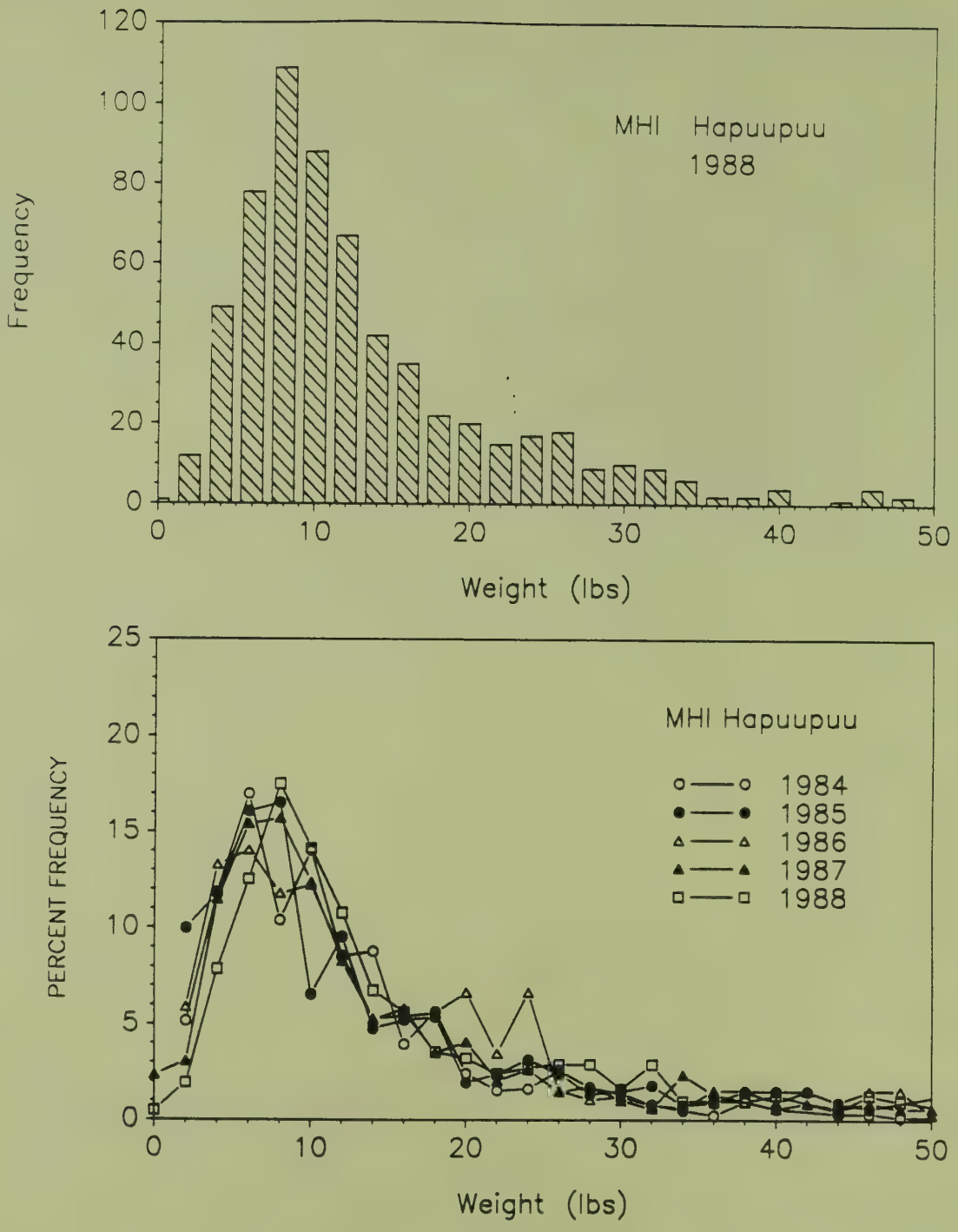

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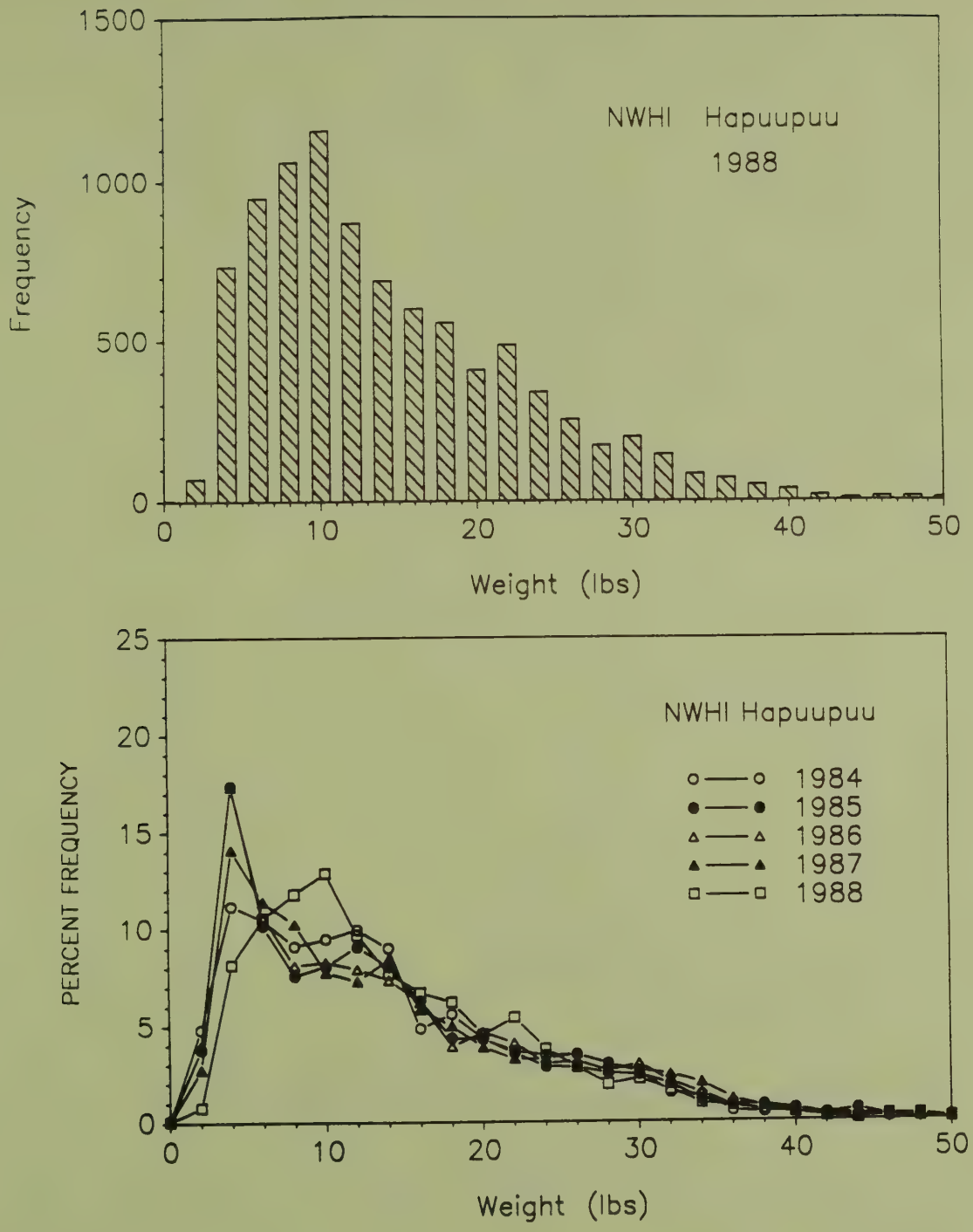

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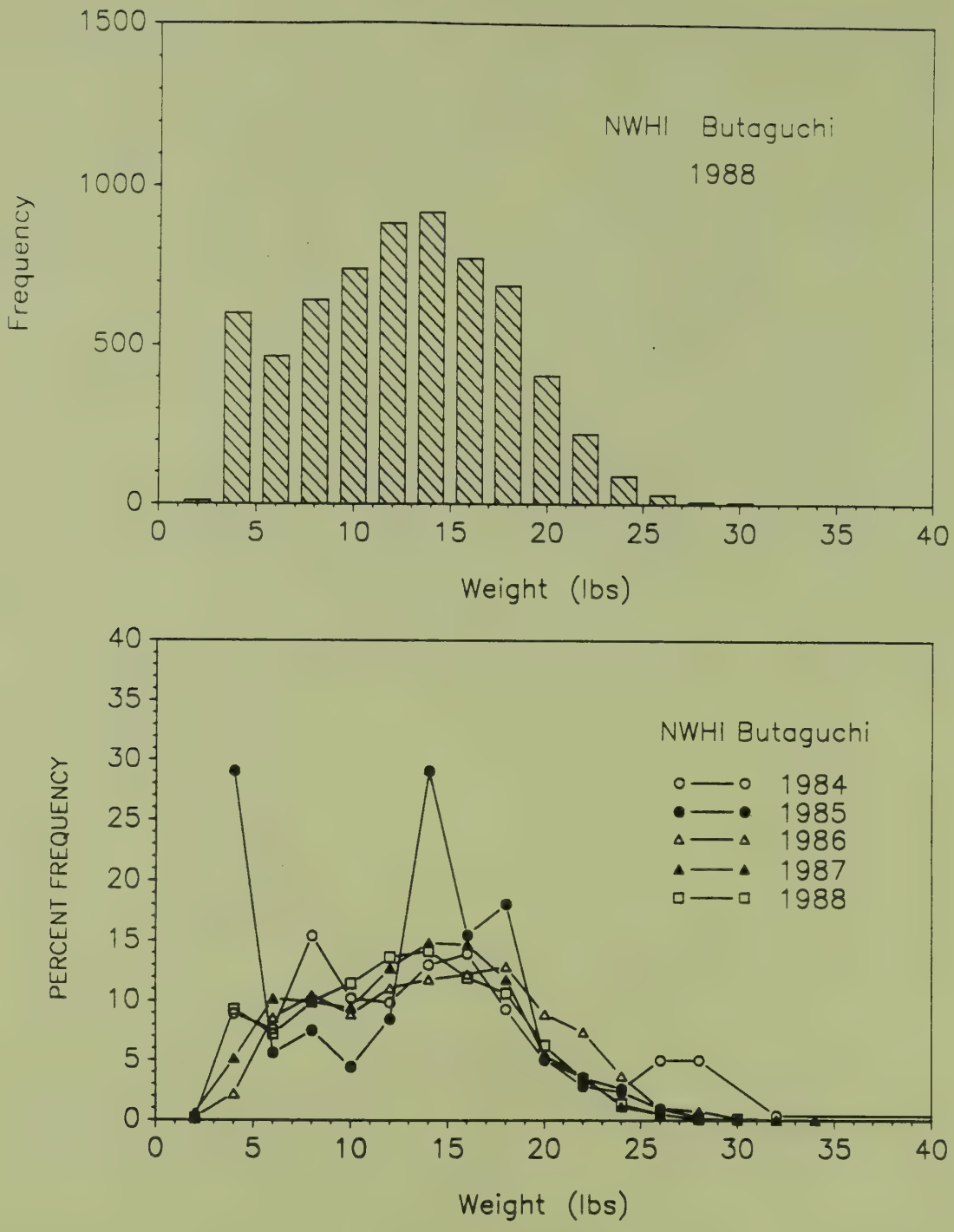

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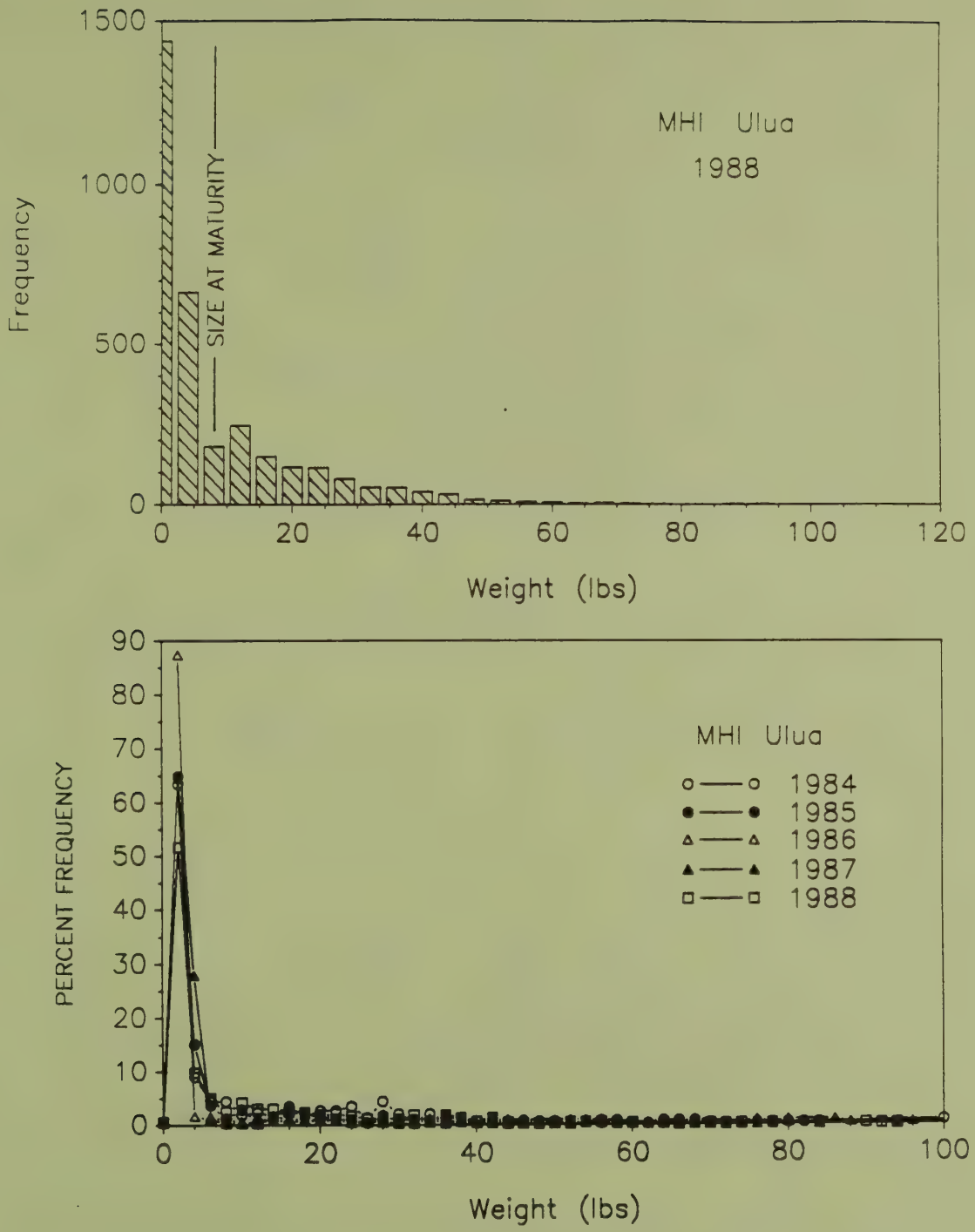

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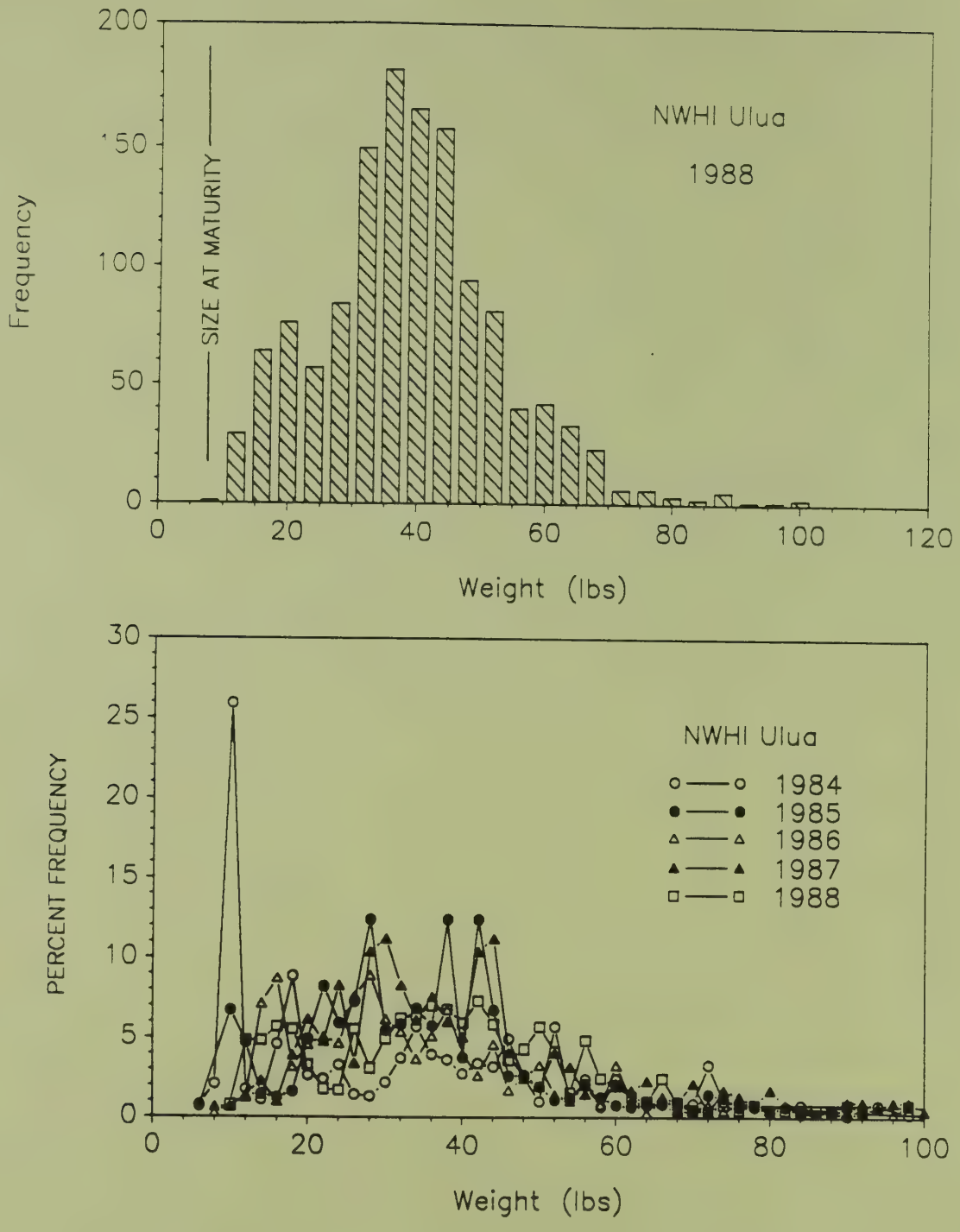

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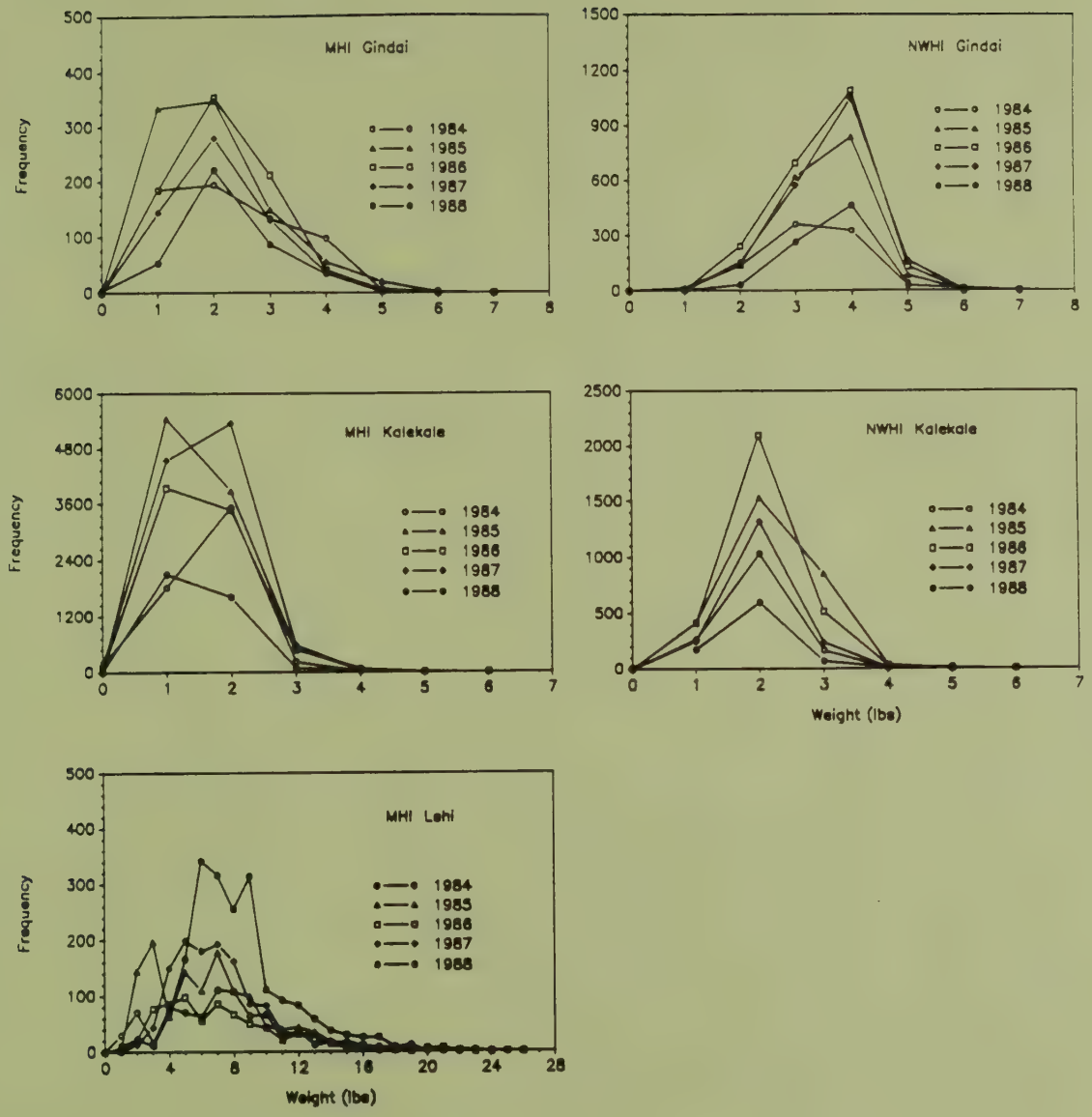

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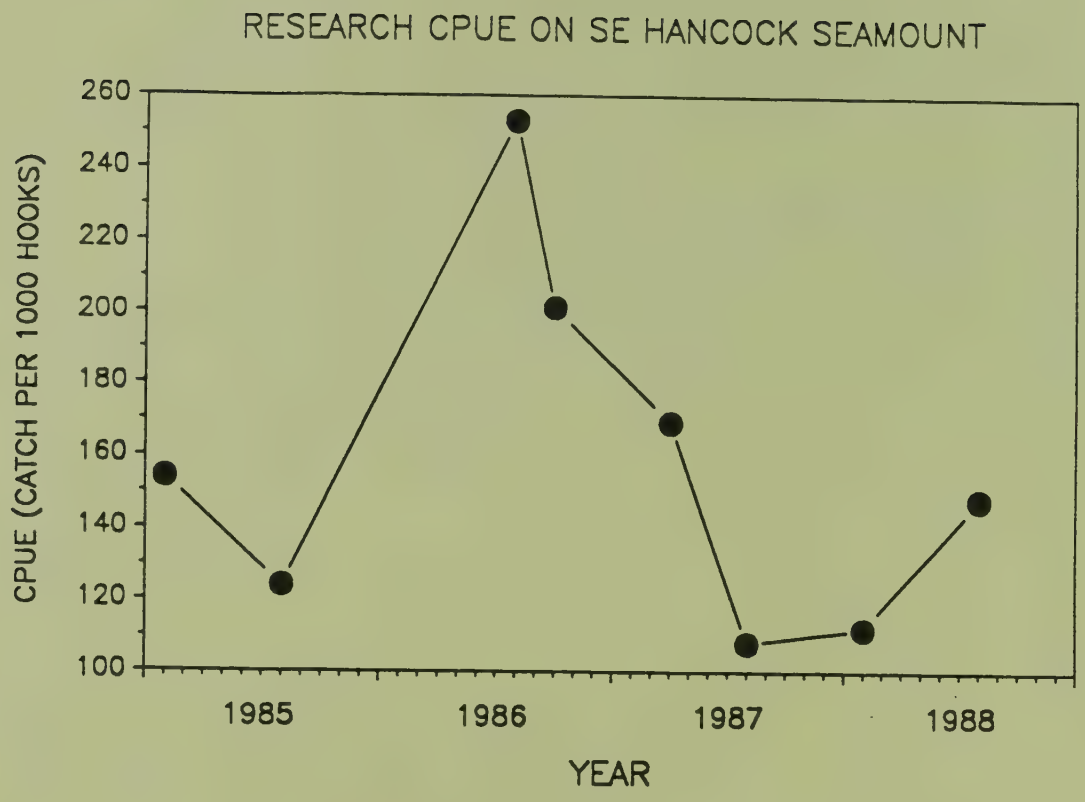

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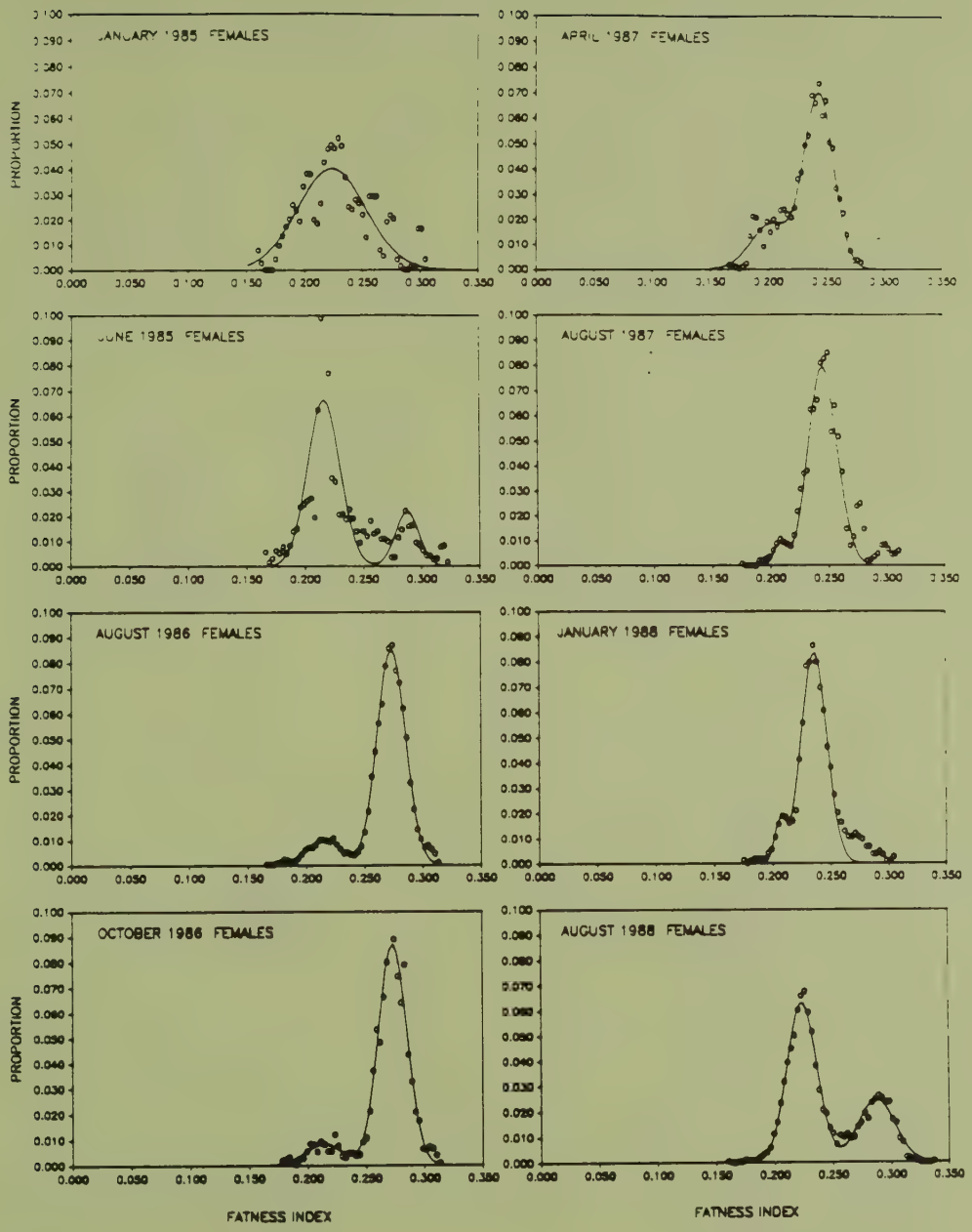

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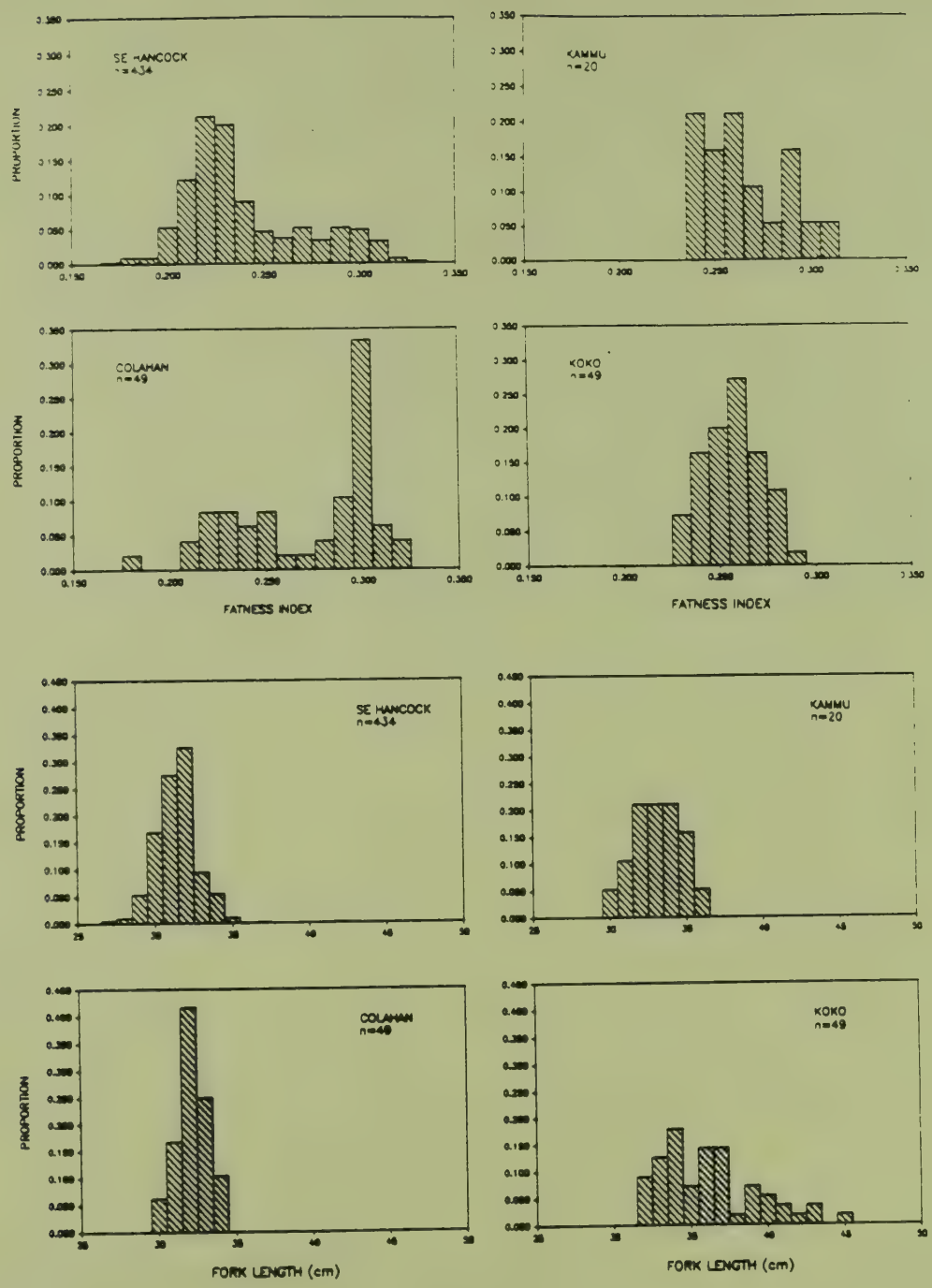

Figure 18. Frequency histograms of armorhead fatness index and fork length (both sexes combined) from Southeast Hancock, Colahan, Kammu and Koko Seamounts.

APPENDIX 2

D-R-A-F-T

STATUS OF HAWAII'S BOTTOMFISH FISHERY IN 1988

JUNE 1989

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Western Pacific Regional Fishery Management Council's

BOTTOMFISH PLAN MONITORING TEAM

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INTRODUCTION

The Bottomfish and Seamount Groundfish Fishery Management Plan (FMP) of the Western Pacific Fishery Management Council (Council) calls for an annual report on various aspects of the regulated fisheries. The plan monitoring team has taken the approach of preparing a series of independent reports (modules) to make up the annual report. This section is the module providing estimates of the total volume of Hawaii's bottomfish landings in 1988, a long-term perspective on landings, and information on the operational and economic performance of the fleets.

RECENT DEVELOPMENTS

Activity in the Northwestern Hawaiian Islands (NWHI) bottomfish fishery declined substantially in 1988, while total landings from the main Hawaiian islands' (MHI) fishery apparently increased substantially. Most of the MHI increase came from an apparently cyclical increase in the landings of uku (a gray snapper). The fresh fish market for bottomfish remained strong, with average bottomfish prices at $2.71 per pound. Imports of fresh and fresh/frozen bottomfish into Hawaii declined slightly to 13% of the total market.

A limited entry program was implemented in the NWHI bottomfish fishery in January, 1989. This will change the dynamics of fishing vessel entry and exit substantially in the forthcoming years. In 1988, although 28 vessels held permits to fish in the NWHI (before the implementation of the limited entry program), only 13 vessels actually fished. Whereas eight vessels were fishing full-time for bottomfish by the end of 1987, by the end of 1988 only four vessels were fishing full-time. Most of the vessels that left the bottomfish fishery entered the longline tuna fishery which expanded dramatically in 1988.

The increased landings of the tuna longline fishery in 1988, coupled with the increased landings of MHI bottomfish and the resultant decrease in expected prices, have been factors in the decision of many NWHI bottomfish fishermen to leave the fishery. The low levels of NWHI landings, coupled with the increased distances traveled and increased difficulty in finding and catching opakapaka (the prized species), are also strong negative factors. In addition, rough winter weather in 1988 caused many vessels to tie up.

Most of the NWHI skippers have reported that bottomfish catch rates on individual banks have been going down, forcing them to search more banks to make a productive trip. There has also been a growing trend toward a more "mixed bag" in landings (wider diversity in species composition). The increased price of hapuupuu (a sea bass) has caused skippers to target that species, as well as opakapaka. The larger size and longer shelf life of this species is ideal for the longer trips, and the general strategy has been to fish for hapuupuu early in the trip and then to target the other more delicate species toward the end of the trip.

NWHI FLEET OPERATIONS

NWHI fleet operations are monitored in Honolulu on the island of Oahu by technicians of the Fishery Management Research Program. Since some vessels may off-load on the islands of Kauai, Maui or Hawaii, our monitoring program could under-estimate fleet activity.

Thirteen different vessels made 93 bottomfish fishing trips to the NWHI in 1988. This represents a 50% decline in active vessels and a 30-45% decline in the number of trips from 1986 and 1987 (Table 1, Fig. 1). During 1988, there were 7-10 vessels fishing the NWHI regularly, but by year's end only six vessels appeared to be active participants, two of which had just entered the fishery in 1988. The NWHI bottomfish fishing vessels fished the entire NWHI archipelago from Nihoa island to Kure atoll. A breakdown of farthest distance traveled per trip showed that 58 trips (52%) were made to the Ho'omalu zone (the region of the NWHI northwest of Necker island (165 degrees west longitude), which became the limited entry zone in 1989. Trips to the Mau zone (between Kauai and Necker) comprised 20% of the total, while the remaining 28% of the trips were to unknown locations in the NWHI.

Individual vessels made as few as one trip to the NWHI during the year, and as many as 14. The average number of NWHI trips per vessel in 1988 was seven, which is an increase from four in 1987 and six in 1986. This increase reflects the seriousness of a core group of fishermen who have persevered in the fishery following previous years' heavy competition and declining catch rates for prized species. The average NWHI bottomfish fishing trip lasted 15.25 days with 7.0 days fishing and 8.25 days traveling. Trip length was greater in 1987 due to the longer traveling time (9.25 days traveling and 7.0 days fishing).

Average NWHI landings per trip (for those trips monitored by NMFS) in 1988 were 6,900 lb, down slightly from 1987. Average landings per trip of Bottomfish Management Unit Species (BMUS)

were 5,500 pounds in 1988, down 10% from 1987. BMUS accounted for 80% of landings by bottomfish fishing vessels in the NWHI in 1988, compared to 84% in 1987 and 83% in 1986. In other words, the NWHI bottomfish fishing fleet generally continued to concentrate its effort on bottomfish.

HAWAII BOTTOMFISH MARKET

The bottomfish fishery in Hawaii is monitored in two ways: the State of Hawaii's Division of Aquatic Resources (HDAR) compiles commercial fish landings reports, and the NMFS Fishery Management Research Program monitors sales of fish at a number of wholesale locations. Both systems have significant limitations, and neither accounts for fish caught by recreational and subsistence fishermen.

We believe that the HDAR system under-estimates landings in Hawaii because of incomplete reporting. These data are probably biased further by differences in the level of reporting in different segments of the fishery. Furthermore, the HDAR data are delayed for 1988 and, accordingly, are not available for this report. Nonetheless, HDAR figures on bottomfish landings through 1987 are presented in Table 2.

The NMFS monitoring system is limited by the extent of its sample of total landings. The sample changes slightly each year in terms of number of days monitored and the variables (species, locations, etc.) measured. In 1988, we began to include a "condition" code for each fish, representing whether it was whole, gilled and/or gutted, etc. In the bottomfish fishery this was usually not significant because almost all fish were sold whole, but for pelagic species it could be significant. The data were scaled by the condition code to the equivalent whole-fish weight.

The monitoring data were also expanded to an estimate of total market quantities based on our understanding of the proportion of total market volume represented by the monitoring sites. The basis of this expansion should change as the market changes, but we do not have a reliable method to make those adjustments. Expansion factors have been static, therefore, for the 5 years we have monitored the bottomfish fishery. These expansion factors are based on a 1979 survey of wholesale markets in Hawaii, and on information on the landing patterns of specific fleets. The expansion factors range from 1.0 (indicating our sample represents the entire market for a particular gear and species combination) to 2.0 (indicating our sample is half the total market).

We believe our coverage of NWHI bottomfish landings for 1988 was adequate, but we are more doubtful about our coverage of the

bottomfish harvest from the MHI, so comparison of estimates from one year to the next must be made with care. Furthermore, examination of particular gear-species combinations suggests that for the main Hawaiian islands bottomfish, the expansion factors may be too small. At present, there is no means of correcting for this problem, but we are attempting to expand the number of outlets and islands where sampling is conducted, and to field a new survey of wholesale dealers. The Council's voluntary log book program for the NWHI bottomfish fishery has been amended to provide additional information on the disposition of those fish.

Our market-monitoring program also collected price information. Average prices were adjusted during the market volume expansion procedure to account for differences in prices between sales locations. Estimates of Hawaii bottomfish sales showed a significant decline in landings from the NWHI in 1988, and a substantial increase in landings from the MHI (Table 3, Fig. 2). Prices for major species from the NWHI rose slightly in 1988, while those from the MHI rose substantially (Table 4, Fig. 3). The overall economic value of Hawaii's bottomfish fishery has continued to grow in terms of total revenue generated in the market (Table 3, Fig. 4).

The top five bottomfish species accounted for 88% of BMUS landings of NWHI vessels in 1988 (Table 5, Fig. 5). For the first time, opakapaka (a pink snapper) did not dominate landings, amounting to only 25% of weight landed in 1988, compared to 36% in 1987. Hapuupuu (a sea bass) also supplied 25% of the landings. Butaguchi (a jack) comprised 18%, while onaga (a red snapper) comprised 13% of landings. In revenue terms, these figures are quite different, with the higher prices for opakapaka and onaga than hapuupuu and butaguchi, thus raising the shares of the former. Species composition is not given for the MHI as a whole because of potential biases in our sample frame.

BOTTOMFISH IMPORTS TO HAWAII

Data on fish imports to Hawaii are compiled by the Southwest Region, NMFS, from U.S. Food & Drug Administration (FDA) sources. Imports of bottomfish to Hawaii, largely from Pacific island countries such as Fiji, declined in 1988 to 334,000 pounds (Fig. 6). Almost all of the imports were snappers. For several years, American Samoa and Guam were sending substantial volumes of bottomfish to Hawaii, but in recent years the quantities have not been sufficient for tracking by the FDA's data system.

ECONOMIC AND FLEET RESEARCH

Our major economic research project in 1988 was an attempt to describe the economics of vessel operation in the NWHI bottomfish fishery. Data on costs of operations for each of the major types of bottomfish fishing vessels were obtained and integrated with operational data for 1987. At present, the 1988 operational data are being integrated with this cost information to provide an overall profile of vessel economics. The final report on this project is expected later this year.

There are no clear categories of vessels by cost or revenue, although there is a clear physical distinction among motor-sailers, larger multi-purpose fishing vessels and smaller bottomfish fishing boats. Using average figures for 1987 costs, ignoring the differences between types of boats, and using fleet-wide average performance figures for 1988, our calculations estimate that NWHI bottomfish fishing vessels made a small profit (net revenue of $6,299, Table 6). This is a "hypothetical" result in the sense that it takes average operating patterns for the fleet as a whole. Some full-time vessels may have done much better, some part-time vessels may have covered their costs during their period in the fishery, and a number of vessels almost certainly lost money. This analysis also suggests that the average vessel operated 44% of the time in the NWHI bottom fishery, the remaining time being spent in other fisheries or inactive. A full-time, "annualized" performance would have generated $16,500 in net revenue for 1988, perhaps more indicative of economic returns to the more active vessels (Table 7). This analysis needs to be examined more carefully before conclusions on economic performance are made.

We have also replicated earlier market research (Pooley 1987) on the price responsiveness of bottomfish in the Hawaii market. The results of this research (Fig. 7) show that bottomfish prices are relatively flexible in response to changes in the quantity on the market. This responsiveness is shown in Fig. 8, which shows the weekly volume of bottomfish sales and average prices for 1988. It is important to realize that the quantities and prices include our estimates of total market volume, including sales throughout Hawaii and imports. The price premium for bottomfish landed from the MHI continues to hold, as shown in Table 4. The highest demand is for MHI bottomfish landed during the holiday season (roughly Thanksgiving through New Year's Day) while the lowest demand is for NWHI bottomfish landed during the "off" season. The main reason for this difference in price, which averaged $1.24 per pound for the five major species, is the freshness of MHI fish.

Because of indications from last year's biological assessment that several bottomfish species in the MHI were stressed by the level of the fishery (Ralston 1988), proposals

were made by some people in the fishery and by the Hawaii Division of Aquatic Resources, to impose new minimum size restrictions for some species. HDAR plans to change existing minimum sizes through its administrative rules and public hearing process in 1989. We investigated briefly the price differences by size for four major commercial bottomfish species (Figs. 9-10). Interpreting the data is difficult because of the many factors which can influence the price. For example, a higher price per pound generally exists for smaller fish, but since the yield for large fish is greater than for medium fish, large fish sometimes have a higher price than the average (except for very small fish, which often have a 100% yield to the wholesaler because they are sold whole and frequently prepared whole).

Another area of economic research included a computer model of the NWHI bottomfish fishery which was made operational this year (Kasaoka 1989). Although further refinement and testing are required before this model can be used for policy purposes, it represents a major step in attempting to understand the relationship between fishery regulations and fishing. The model is a mathematical representation of fishing activity and revenue using an economic technique called linear programming. Basically, the model estimates net revenues (profit) for each of four fishing vessel types (large and medium multi-purpose, tuna longliners and motor-sailers), in each of four fishing areas (upper and lower sections of the NWHI Ho'omalu zone, the NWHI Mau zone and the MHI), in three seasons, for three target species groups (high- and low-priced bottomfish, and pelagics). The model includes vessels (such as longline vessels) which fish only occasionally in the NWHI bottom fishery and species (such as pelagics) that are not found in the NWHI bottomfish fishery, but are sought on occasion by bottomfish fishing vessels. The model is constrained by the number of vessels allocated to each fleet and by the availability of each species group. The model then allocates fishing time for each of the four fleet segments based on optimal profit per area, species and season. This model will be further developed as we gain experience regarding the impact of the limited entry program in the NWHI.

Finally, in a cooperative research project oriented toward American Samoa, Guam and the Northern Mariana Islands, the costs, revenues and operational characteristics of small fishing boats were estimated (Kasaoka 1989). These data will be compiled later this year into an economic analysis of fleet operations in these areas.

RECOMMENDATIONS

Our major recommendation for monitoring and managing Hawaii's bottomfish fishery is to enhance the scope of market sampling in the MHI. Without a reliable, broad scale sample of fish (including average size of fish per lot), we cannot be sure that our current information accurately reflects conditions throughout the fishery and the market, nor can we estimate the impact of potential management measures on different locations through the MHI.

REFERENCES

Kasaoka, L.D. 1989. Linear programming model for the Northwestern Hawaiian Islands bottomfish fishery. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Rep. H-89-2C. 61 p.

Kasaoka, L.D. 1989. Summary of small boat economic surveys from American Samoa, Guam and the Northern Mariana Islands. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Rep. H-89-4C. 47 p.

Pooley, S.G. 1987. Demand considerations in fisheries management - Hawaii's market for bottom fish. In: J.J. Polovina and S. Ralston (eds.), Tropical Snappers and Groupers: Biology and Fisheries Management, Westview Press, Boulder. p. 605-638.

Pooley, S.G. and K.E. Kawamoto. 1988. Economic report on Hawaii's commercial bottom fishery, 1986 (economic module, Bottomfish FMP). Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Rep. H-88-1. 20 p.

Ralston, S. and K.E. Kawamoto. 1988. A biological assessment of Hawaiian bottom fish stocks, 1984-1987. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Rep. H-88-8. 60 p.

APPENDIX A: TABLES

Table 1. Fleet activity, NWHI bottomfish fishery, 1984-88 (based on sample).

	1984	1985	1986	1987	1988
Vessels	19	23	24	28	13
Trips	135.0	160.0	163.0	134.0	93.0
Trips/Vessel	7.11	6.96	6.79	4.79	7.15
Days at Sea	N/A	N/A	2445	2211	1418
Days Fished	N/A	N/A	978.0	938.0	651.0
Days/Trip	N/A	N/A	15	17	15
Days Fished/Trip	N/A	N/A	6	7	7
BMUS (lb)/Trip	4,318	4,659	4,803	6,145	5,502
Total lb/Trip	N/A	N/A	5,805	7,303	6,842
BMUS (lb)/Fishing Day	N/A	N/A	800	877	786
Total lb/Fishing Day	N/A	N/A	967	1,043	977
Revenue/Trip	N/A	N/A	$13,125	$17,462	$16,400
Revenue/Vessel	N/A	N/A	$87,500	$83,571	$117,324

Table 2. Hawaii Division of Aquatic Resources commercial fishing landings, 1970-87.

	Landings	Revenue	Price*
1970	339,502	239,564	2.01
1971	406,006	310,021	2.09
1972	402,173	363,238	2.39
1973	446,139	413,523	2.34
1974	405,864	417,066	2.36
1975	555,255	591,645	2.24
1976	557,835	692,434	2.48
1977	560,447	762,327	2.58
1978	738,070	1,098,093	2.63
1979	692,430	1,120,363	2.57
1980	710,063	1,077,861	2.16
1981	637,841	1,253,469	2.53
1982	746,060	1,587,992	2.58
1983	880,169	1,956,060	2.62
1984	1,028,867	2,376,500	2.64
1985	1,079,619	2,646,412	2.65
1986	1,121,067	2,791,173	2.62
1987	1,087,912	3,103,576	2.95
1988	N/A	N/A	N/A

* Prices calculated from pounds sold, not landings (pounds caught). Prices and revenues adjusted for inflation to 1987 price levels.

Table 3. Landings and revenues of Hawaii bottomfish, 1984-88 (NMFS estimates).

	1984	1985	1986	1987	1988
LANDINGS (lb)					
Hawaii	1,358,000	1,649,000	1,693,000	1,884,000	2,276,000
NWHI	661,000	922,000	869,000	1,015,000	625,000
MHI	697,000	727,000	824,000	869,000	1,651,000
Imports	252,000	264,000	319,000	484,000	340,000
Total	1,610,000	1,913,000	2,012,000	2,368,000	2,616,000
REVENUES ($)					
Hawaii	N/A	N/A	4,500,000	5,300,000	6,000,000
NWHI			1,900,000	2,300,000	1,500,000
MHI			2,600,000	3,000,000	4,500,000
Imports			760,000	1,170,000	800,000
Total	N/A	N/A	5,260,000	6,470,000	6,800,000

Table 4. Prices ($/lb sold) by location caught: Hawaii bottomfish, 1987-88.

	1987			1988		
	Market Ave.	NWHI	MHI	Market Ave.	NWHI	MHI
Opakapaka	3.40	3.27	3.64	3.51	3.54	3.55
Onaga	4.36	3.23	4.81	4.19	3.30	5.06
Ehu	2.71	2.36	3.52	2.82	2.01	3.80
Hapuupuu	1.92	1.87	2.51	1.96	1.84	2.99
Butaguchi (ulua)	1.18	1.16	2.17	1.21	1.05	2.54
Other BMUS	2.03	1.56	5.20	1.96	2.23	1.91
Imports	2.21	N/A	N/A	2.37	N/A	N/A
Total*	2.75	2.33	3.87	2.71	2.37	2.90

* excluding imports

Table 5. Species composition of landings, NWHI bottomfish fishery, 1986-88.

	1986	1987	1988
Opakapaka	297,000	370,000	154,000
Onaga	106,000	77,000	80,000
Ehu	30,000	40,000	45,000
Hapuupuu	210,000	223,000	156,000
Butaguchi (ulua)	160,000	217,000	111,000
Other BMUS	32,000	74,000	75,000
Total BMUS	835,000	1,001,000	621,000
Other BTTM	35,000	14,000	5,000
Total BTTM	870,000	1,015,000	626,000

Table 6. NWHI bottomfish vessel economic performance, 1988. (Fleet average, based on preliminary data)

Revenue		$115,890
Fixed Costs		$ 21,467
Capital	5,152	
Annual Repair	6,572	
Vessel Insurance	6,323	
Administrative	708	
Other	2,712	
Operating Costs		$ 88,123
Fuel & Oil	12,817	
Ice	2,533	
Bait	4,458	
Handling	11,120	
Provisions	5,066	
Maintenance	12,160	
Supplies	3,314	
Gear	755	
Other	200	
Labor income	31,734	
Captain's share	3,967	
NES	0	
Total cost		$109,591
Net Revenue		$ 6,299
Operating Characteristics		
Investment	$285,381	
Trips	7.15	
Catch per day (lb)	977	
Trip Days	15.25	
Fishing Days	7.0	
Crew share	50.0%	
Crew	4.0	
Shared Costs	$52,423	
Product Price	$2.37	
Total Catch (lb)	48,899	
Capital factor	3.4%	
Depreciation factor	4.0%	
Fixed costs share	43.6%	

Table 7: NWHI bottomfish vessel economic performance, 1988. (Annualized full-time operations, based on preliminary data)

Revenue		$265,759
Fixed Costs		$ 47,117
Capital	9,703	
Annual Repair	15,071	
Vessel Insurance	14,500	
Administrative	1,623	
Other	6,219	
Operating Costs		$202,084
Fuel & Oil	29,392	
Ice	5,808	
Bait	10,223	
Handling	25,500	
Provisions	11,617	
Maintenance	27,885	
Supplies	7,601	
Gear	1,732	
Other	458	
Labor income	72,771	
Captain's share	9,096	
NES	0	
Total cost		$249,201
Net Revenue		$ 16,558
Operating Characteristics		
Investment	$285,381	
Trips	16.4	
Catch per day (lb)	977	
Trip Days	15.25	
Fishing Days	7.0	
Crew share	50.0%	
Crew	4.00	
Shared Costs	$120,216	
Product Price	$2.37	
Total Catch (lb)	112,135	
Capital factor	3.4%	
Depreciation factor	4.0%	
Fixed costs share	100.0%	

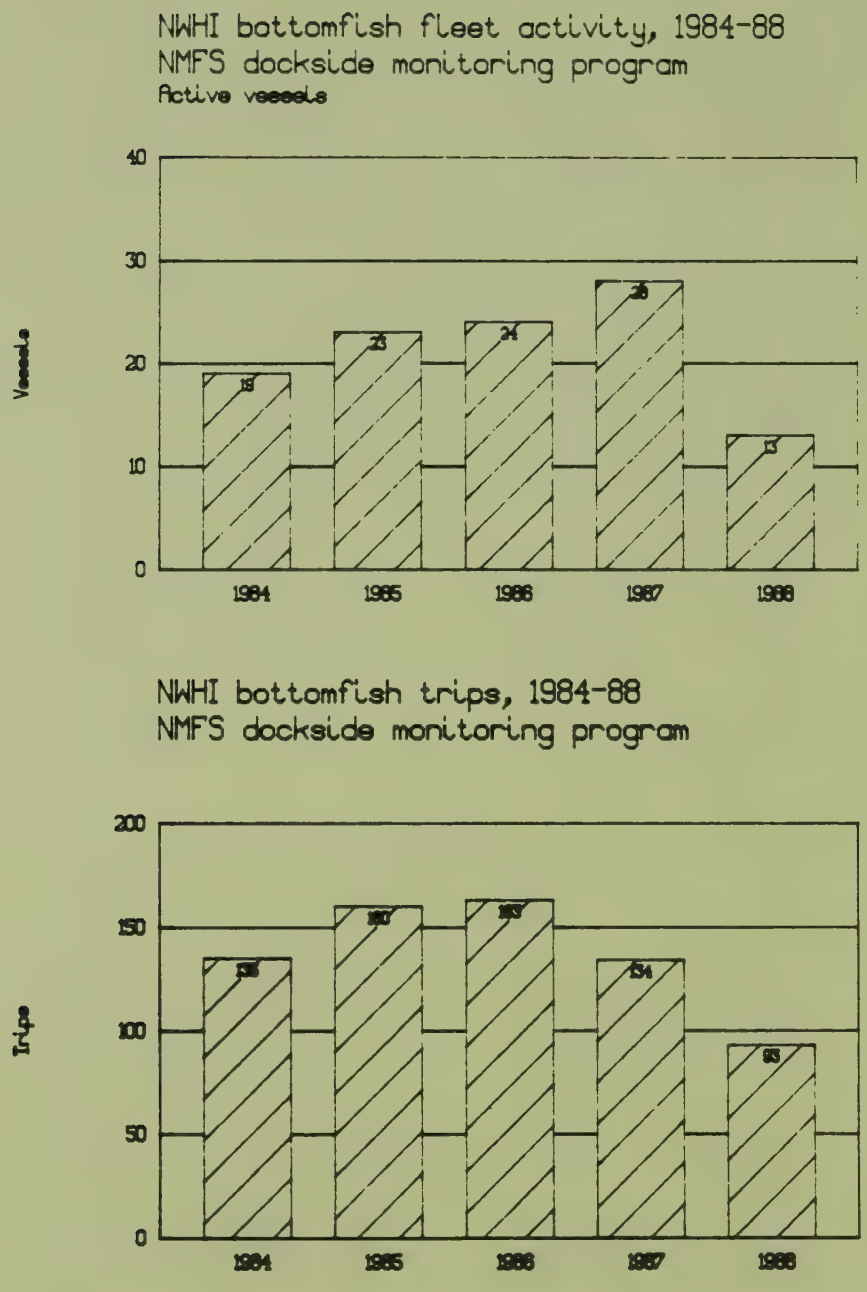


Figure 1. Number of vessels (above) and fishing trips (below) for the NWHI bottomfish fishery, 1984-88.

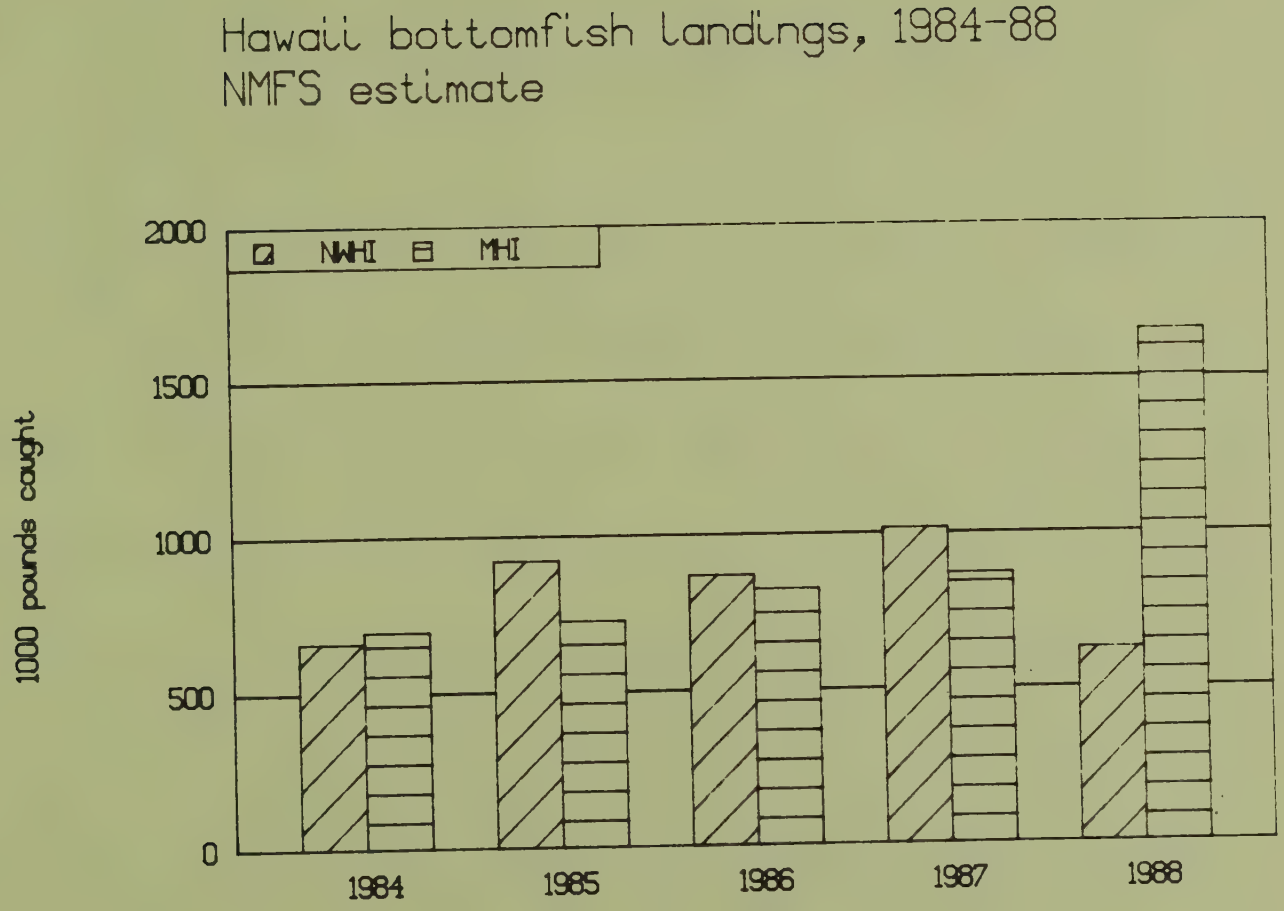


Figure 2. Landings of Hawaii bottomfish, 1984-88 (NMFS estimates).

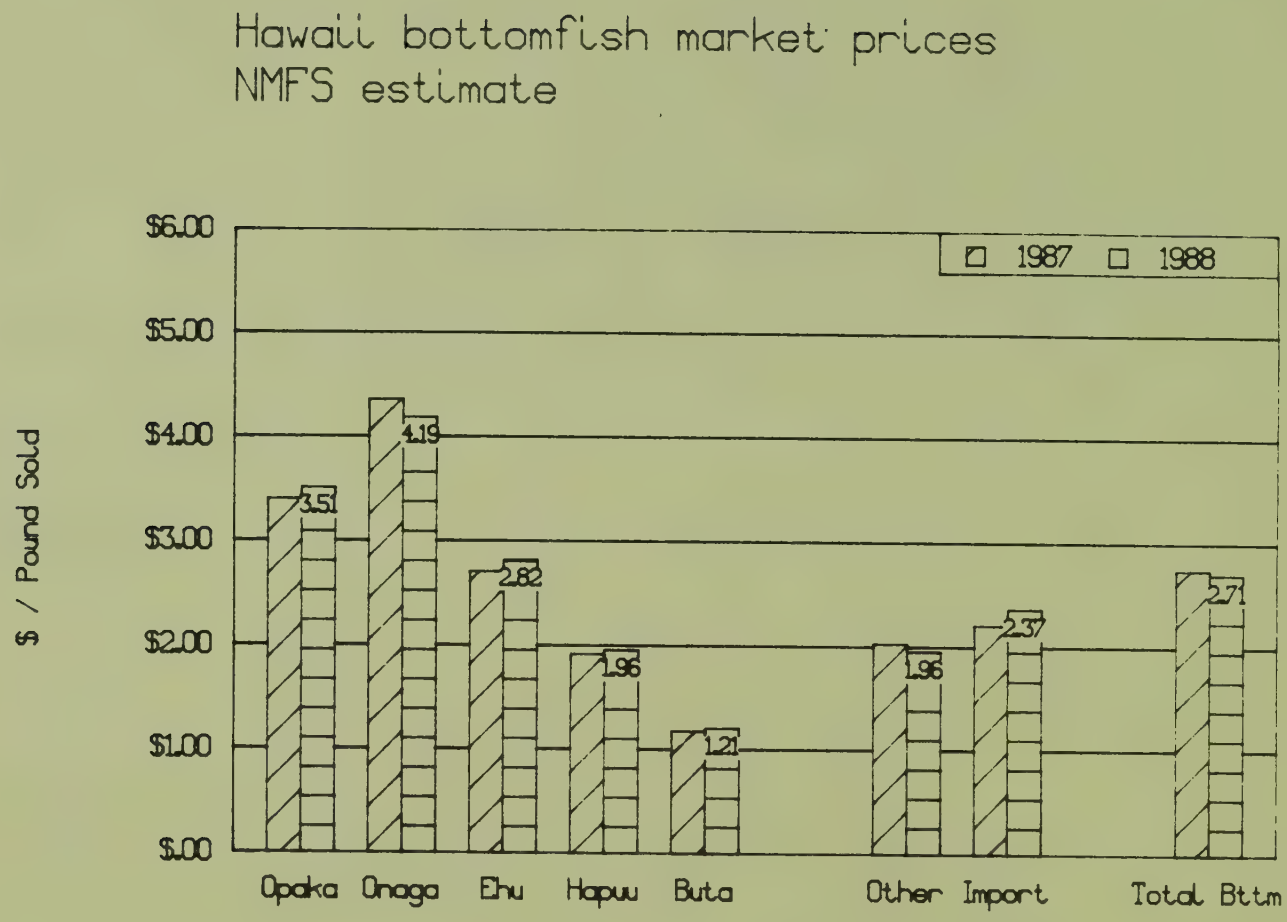


Figure 3. Prices of Hawaii bottomfish, 1987-88.

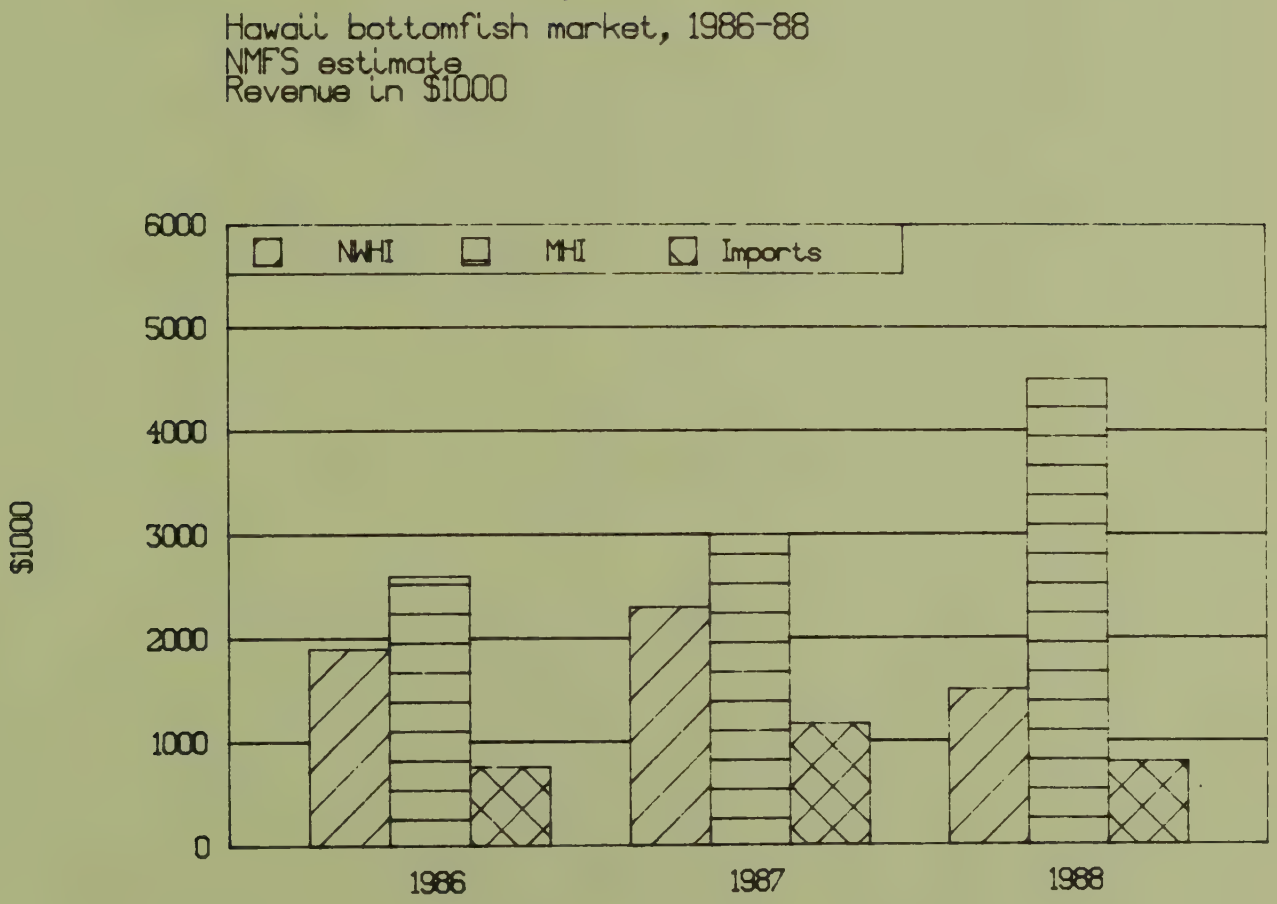
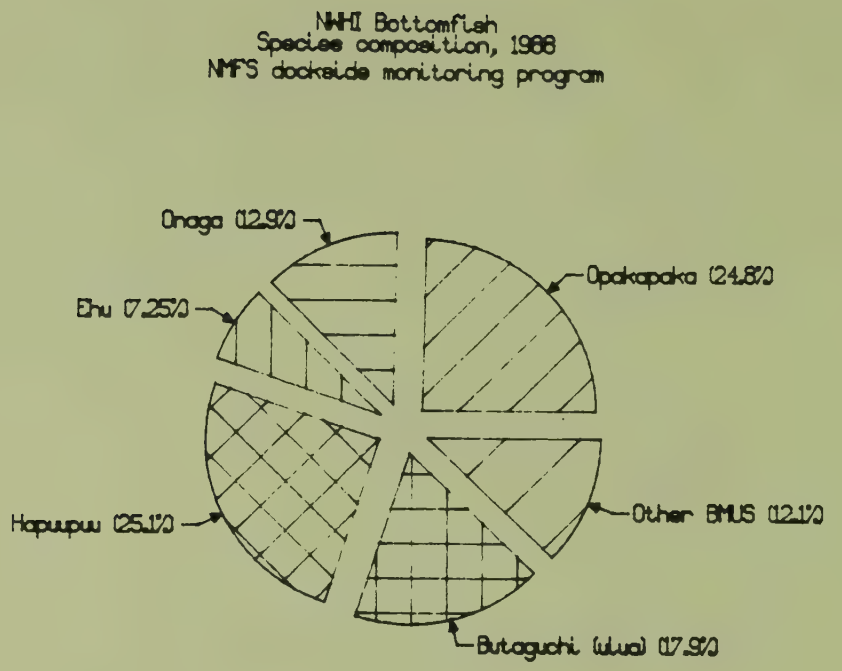


Figure 4. Revenues: Hawaii bottomfish, 1986-88.



Species composition, 1987

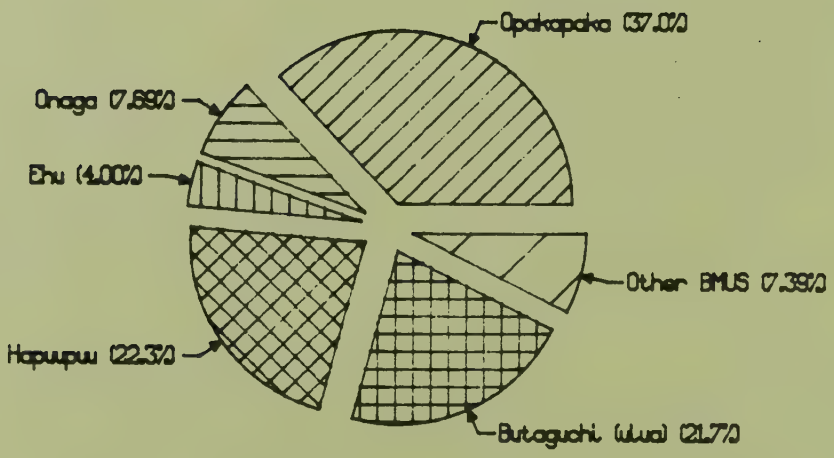


Figure 5. Species composition of landings, NWHI bottomfish fishery, 1987 and 1988.

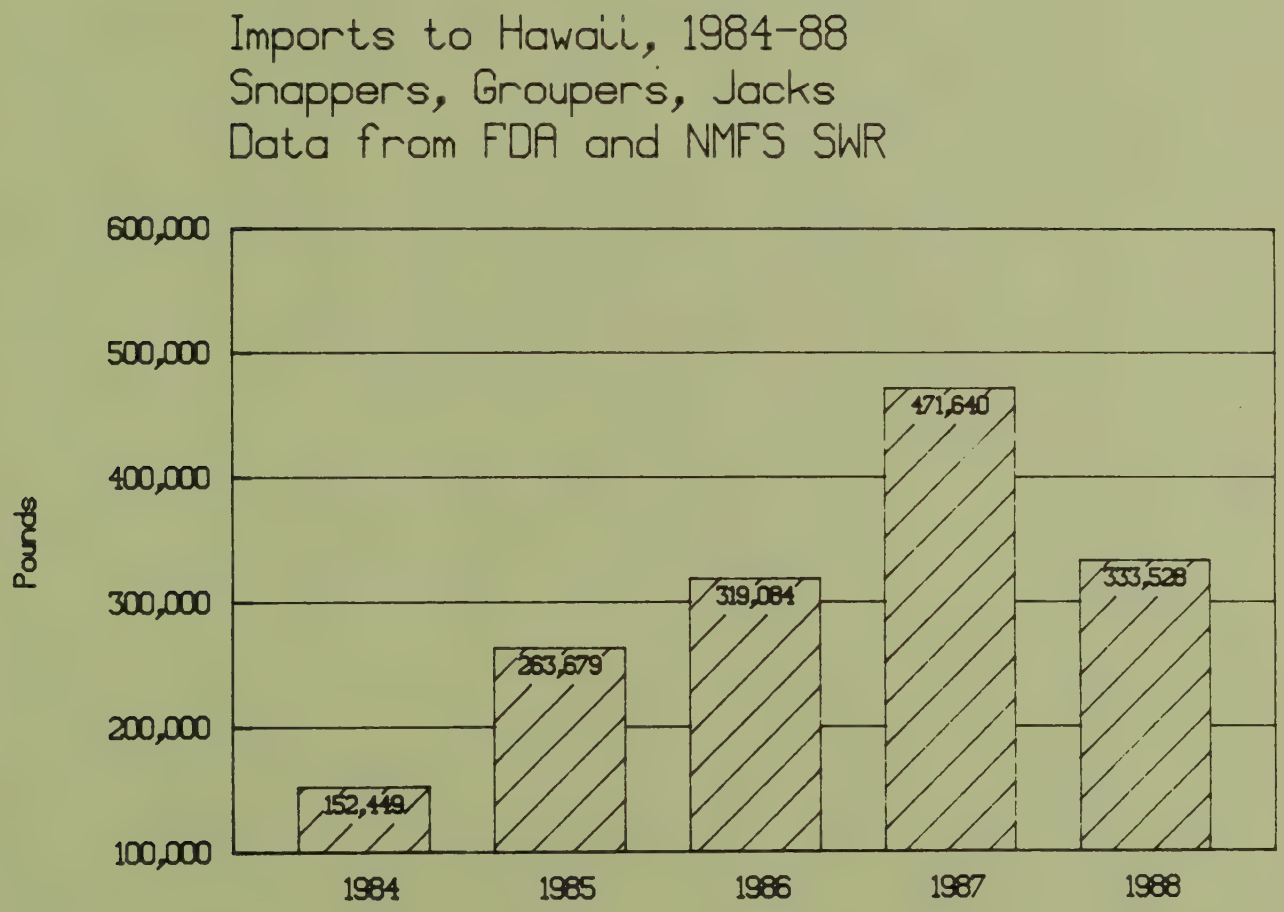


Figure 6. Imports of bottomfish to Hawaii, 1984-88.

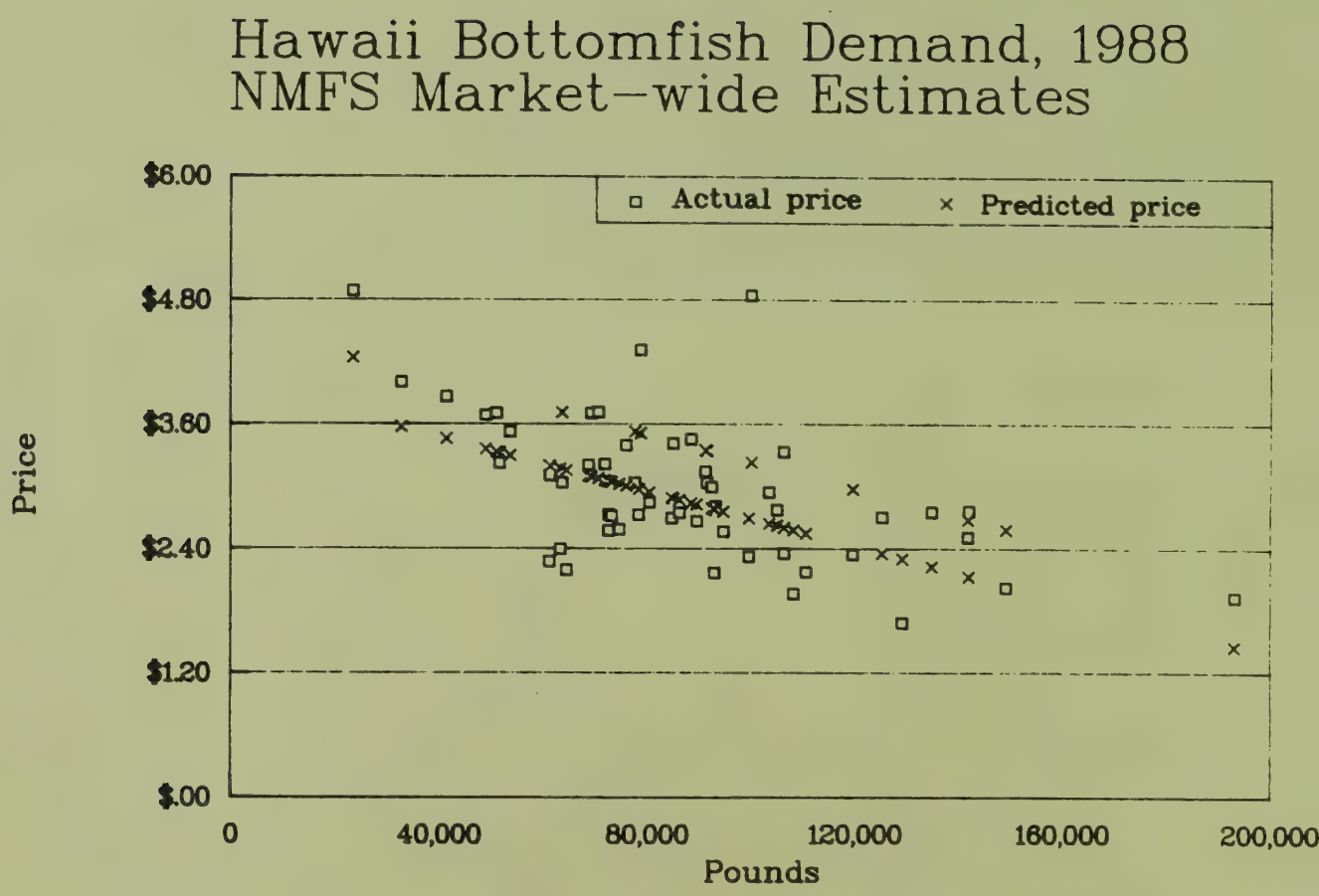


Figure 7. Hawaii bottomfish demand relationship (average price and pounds sold weekly), 1988.

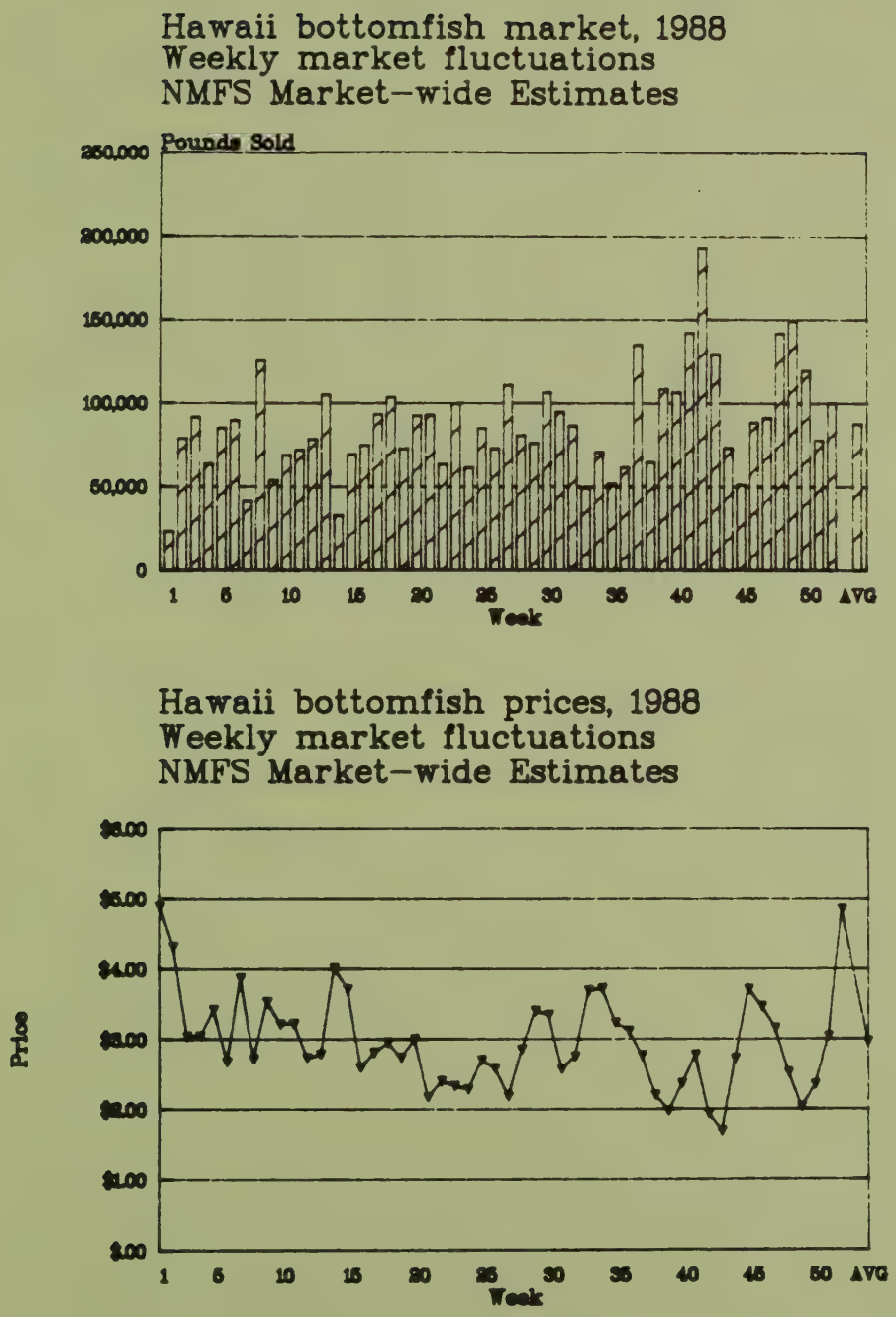
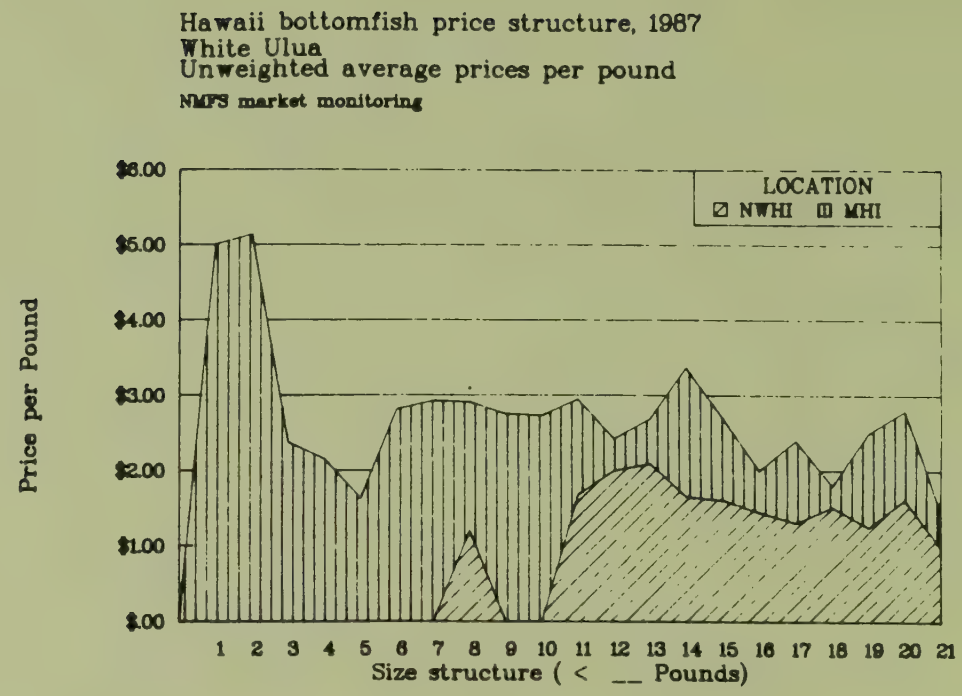


Figure 8. Market sales (above) and average prices (below) by week: Hawaii bottomfish, 1988.



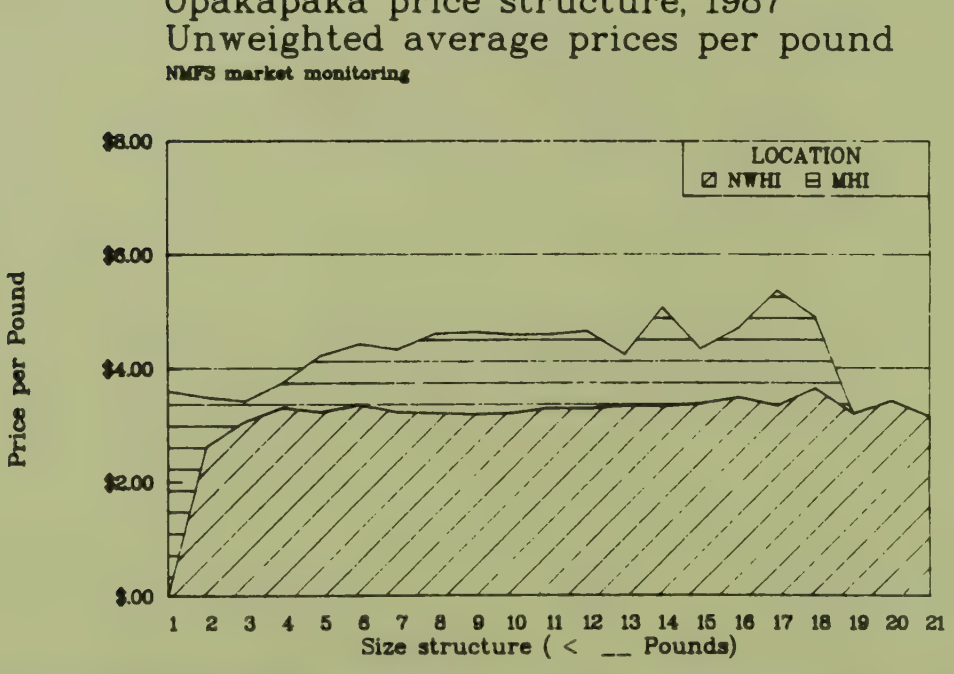
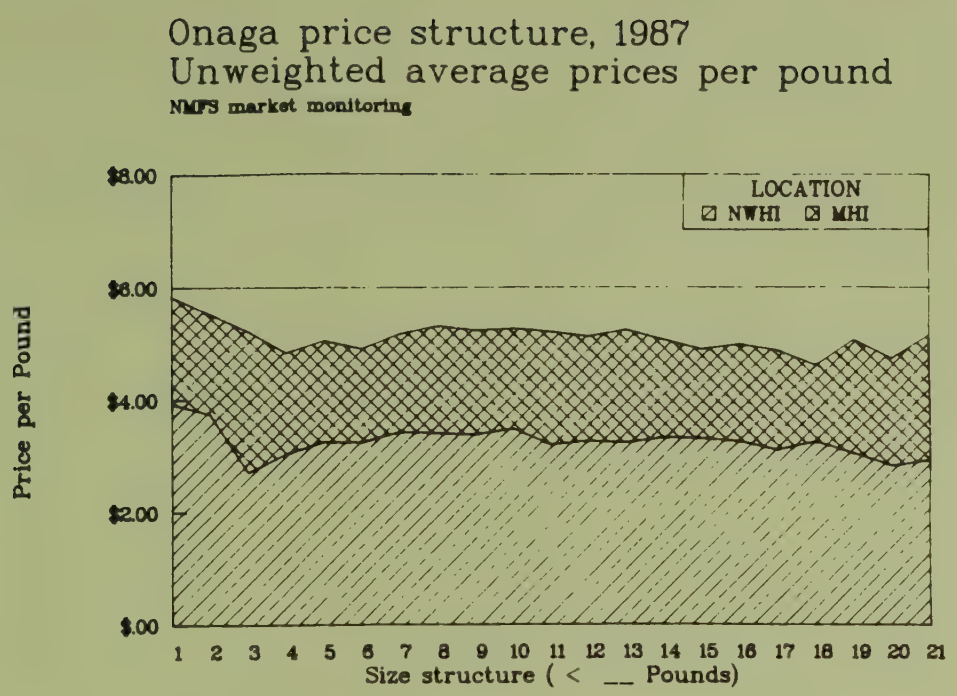


Figure 9. 1987 average prices by size for white ulua (above) and opakapaka (below).



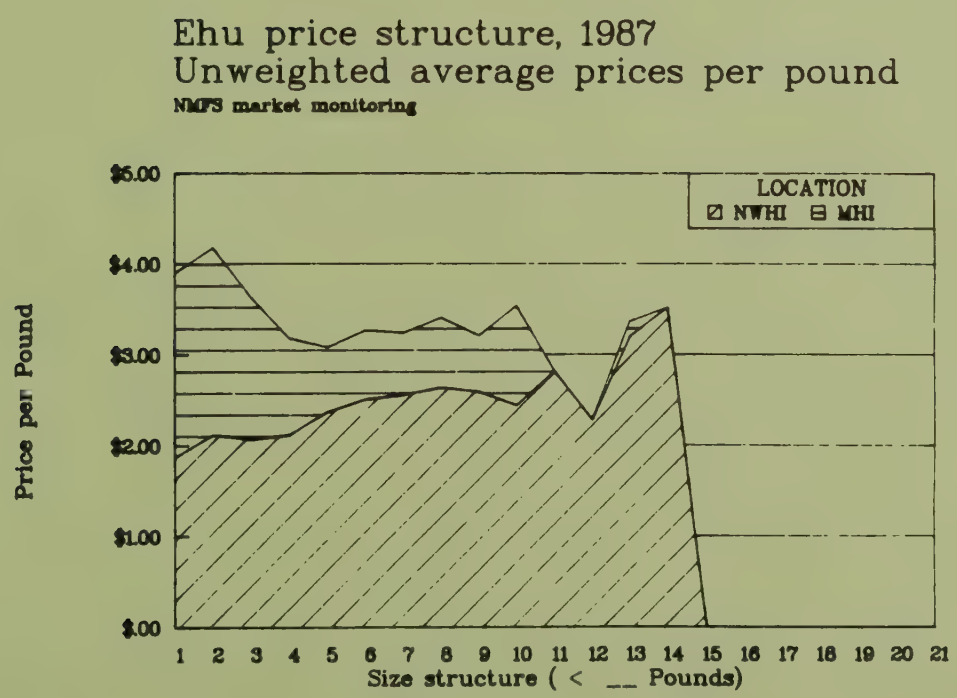


Figure 10. 1987 average prices by size for onaga (above) and ehu (below).

APPENDIX 3

ANNUAL REPORT FOR THE 1988 BOTTOMFISH FISHERY OF THE TERRITORY OF AMERICAN SAMOA

JUNE 1989

PREPARED BY

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FOR THE

Western Pacific Regional Fishery Management Council's

BOTTOMFISH PLAN MONITORING TEAM

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INTRODUCTION

The Fishery Management Plan (FMP) for the Bottomfish and Seamount Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) in 1986. The Western Pacific Regional Fishery Management Council (Council) developed the FMP to manage the bottomfish and seamount resources occurring in its area of jurisdiction as defined in the Magnuson Fishery Management and Conservation Act of 1976.

The Bottomfish FMP required the Council to establish a Bottomfish Plan Monitoring Team (Team) to prepare an annual report on the status of the bottomfish fisheries for each of the island areas served by the Council. The Team decided to adopt a modular approach to developing the annual report, whereby each island area would develop an individual report for its bottomfish fishery and would submit it to the Team for review. This is the third annual report module submitted to the Team on behalf of the American Samoa Department of Marine and Wildlife Resources (DMWR) to help the Team determine the effectiveness of the FMP in meeting its goal in the American Samoa.

Preparation of this report was a cooperative effort among staff of NOAA Fisheries Honolulu Laboratory's Western Pacific Fishery Information Network (WPACFIN) and a newly appointed Team member from the DMWR. Most data processing was done by WPACFIN in Honolulu but was based entirely on data collected by DMWR. The majority of the text was prepared by DMWR's Team member. The DMWR is upgrading its computer processing capabilities to enable the new Team member to complete all processing for writing future reports. The WPACFIN is assisting DMWR in meeting this goal. Through cooperative efforts of the agencies involved, this annual report on the bottomfish fisheries of American Samoa is the official submission of the DMWR to the Team for the 1988 calendar year.

This report provides data for 1988 and updates the time series of published data on the bottomfish fishery of American Samoa. It does not review all previously described and published information on the fishery. For additional background information on American Samoa's data collection systems, assumptions, and analyses used to summarize data in this report, the bottomfish fishery, or specifics on other American Samoan fisheries, refer to DMWR annual reports (Aitaoto 1988), the Team's other annual reports, volumes of WPACFIN's "Fishery Statistics of the Western Pacific" (Hamm and Kassman 1986; Hamm and Quach 1988b, 1989), or Hamm and Quach (1988a).

Before October 1985, DMWR obtained most of the bottomfish catch and effort data through interviews with fishermen and catch examinations made at landing sites and time of landing. The DMWR attempted to obtain data from every boat and for as many fishing trips as possible. On 1 October 1986, DMWR implemented a new fisheries data collection system: a systematic, random sampling program that stratifies sampling by type of day, either weekday

or weekend-holiday. Sampling was done for 2 weekdays and 1 weekend-holiday per week. Data summaries in this report are therefore adjusted to account for the percent coverage of the sampling program.

I. STATUS OF THE FISHERY

Overview

Tables 1-6 and Figures 1-12 summarize annual and monthly fishery performance data for 1988 and update the time series available for establishing trends in the fishery.

The 1988 total harvest of bottomfish for American Samoa is estimated at 59,811 pounds. This total catch by 20 local vessels generated an ex-vessel revenue of $97,245. Bottomfish landings peaked in 1983, dropped 25% in 1984, and remained essentially at that level for 3 years before making a further drop (70%) in 1987. The 1988 landings were double the 1987 record low landings (Figure 1).

The 1988 catch per hour, the highest on record, is a reassuring sign after the radical decline in the bottomfish fishery in 1987. The bottomfish fishery has been the second most important fishery, after the pelagic fishery, in the past 6 years (Figure 2).

An influx of fresh bottomfish imported from Western Samoa in the past 4 years has caused some concern amongst the local fishermen. Recently adopted fishery regulations will enable DMWR to monitor the importation of fresh fish into the territory.

Between 1983 and 1985, bottomfish fishermen experienced problems in finding outlets to sell their catches. A proposed fish processing project that will buy fresh fish from the local fishermen is scheduled to begin operation in late 1989.

Total Landings and Trends

After the lowest drop of bottomfish landings on record (in 1987), total bottomfish landings and percent bottomfish management unit species (BMUS) of the total commercial fishery increased in 1988 (Figure 3). Overall, BMUS landings declined during the past 6 years, with the first notable increase in 1988 (Figure 4).

Bottomfish Catch Compared to Other Fisheries

The bottomfish fishery has comprised as much as 50% of the total commercial catch in the past 6 years. Comparison of the monthly trends in the bottomfish fishery to other fisheries is shown in Figure 5. Total commercial landings (Figure 6) and commercial landings attributable to the BMUS (Figure 4) increased in 1988 after declining in 1987. Commercial landings of the various fisheries for 1982-88 are in Figure 2.

Revenue and Other Economic Indicators

Table 1 provides the 1988 estimated ex-vessel value of the bottomfish landings by species. Figure 6 shows an increase in the total value of bottomfish landings from 1987 to 1988. Table 2 provides monthly estimated commercial bottomfish landings summaries of pounds, values, and average price per pound by species for 1988.

Fleet Dynamics

In 1987, a hurricane destroyed the entire fishing fleet of the Manu'a Islands, resulting in the lowest recorded number of vessels landing bottomfish (Table 3, Figure 7). Three 29-foot catamarans (alias) were purchased in 1988 from Western Samoa, through DMWR to replace the damaged village-owned vessels. The number of vessels landing bottomfish has declined since it peaked in 1985 (with a total of 46 vessels) but increased slightly in 1988.

An important factor contributing to the decline in the bottomfish fleet in the past 5 years is the decrease in the number of Western Samoan fishermen who fished for American Samoan boat owners. These fishermen have either returned to their home country or found other more lucrative employment.

Number of Trips and CPUE

The number of bottomfish fishing trips increased slightly in 1988 after drastically declining in 1987 (Table 3). Two assumptions were made when calculating the estimated number of fishing trips per year: all fish landed by a vessel on a given day were caught on a single trip, and each trip using the bottomfish method was included even if trolling also was employed. Average trip length and catch-per-hour calculations were made by using data from exclusive bottomfish fishing trips.

The 1988 catch-per-hour figure of 17.5 (Table 3, Figure 8) is the highest on record. This can be attributed to the more skillful fishermen remaining in the fishery and the reduced effort exerted on the stocks. Nevertheless, more analysis is needed to further explain the prominent CPUE recorded in 1988.

Characteristics of the Catch
Geographical and Seasonal Variations

In general, most of the bottomfish were caught in areas 31, 33, and 36 over the past 7 years (Table 4, Figure 9), although other areas such as 9, 12, 32, 34, and 35 ranked in the top three most productive areas for certain years. During 1988, the offshore area of East Bank ranked third in overall production levels, which demonstrates a possible shift of the fleet to areas farther from shore. Recovery of the Manu'a bottomfish fishery after the devastating hurricane in 1987 was also evident by landings being recorded from areas 41 and 45.

The seasonality of the BMUS landings is compared with the tuna and the PMUS landings of the pelagics fishery in Figure 5. Three peak periods of bottomfish landings in American Samoa occurred during March, July, and October (Figure 10). Further analysis is needed to explain this general occurrence.

Species Composition

About 60% of the recorded bottomfish landings were identified to species in 1988 (Table 5). This is the best identification of bottomfish catch on record and has resulted in a better representation of the species landed in American Samoa.

If the assumption is made that the identified portions of the catches are representative samples of the true percent composition of the fishery, the unidentified catch can be allocated appropriately to individual species (Table 6). Figure 3 shows the cursory analysis of these allocated data and the plotting of percent BMUS of the total commercial landings. Percent species composition of six of the major species is presented in Figures 11 and 12. The 1988 landings by species or group are in Table 1. The redgill emperor, Lethrinus rubrioperculatus, appeared for the first time in the annual estimated commercial bottomfish landings tables as a result of the improvement in species identification. Redgill emperors were landed in past years but were lumped into the miscellaneous emperors and bottomfish categories.

The DMWR Statistical Analysis Division and the WPACFIN program have partially succeeded in reducing the species identification problems expressed in the Team's second recommendation for Council action in the 1987 BPMT Annual Report.

Maximum Sustainable Yield

The estimated maximum sustainable yield (MSY), 45 metric tons (99,000 pounds) per year, for American Samoa, was essentially reached during 1983-86. In 1988, following the drastic decline in total bottomfish landings in 1987 to only 30% of the MSY, 60% of the MSY was achieved.

Summary Table of Fishery Status.

Status of the American Samoa Bottomfish Fishery

Problem Condition	Present in the Bottomfish Fishery	Comment
1. Age at entry is prereproduction	Data not available	
2. Unacceptable ratio of fish mortality to natural mortality	Data not available	
3. Catch exceeds maximum sustainable yield	Not indicated	
4. Significant decline in CPUE	Not indicated	Highest catch/hr on record in 1988
5. Substantial decline in ex-vessel revenue relative to baseline levels	Not indicated	WPRFMC/DMWR/NMFS vessel economics survey data being processed by Honolulu Laboratory
6. Significant shift in gear by area	Not indicated	
7. Significant change in the frozen/fresh components of catch	Data available in 1990	New fisheries regulation requirement
8. Unstable pattern of entry/exit to the fishery	Yes	1988 recovery after 1987 drastic decline
9. Per trip costs exceed per trip revenues	Data unavailable	Data available next year; refer to item 5 above
10. Significant decline or increase in total bottomfish landings	Not indicated	Slight increase in 1988

Problem Condition	Present in the Bottomfish Fishery	Comment
11. Change in species composition of catch	Not indicated	Best species ID on record
12. Research results indicate problems	Data unavailable	
13. Habitat degradation or environmental problems	Data unavailable	Hurricane in 1987; no follow up on initial survey
14. Increased interaction with protected species	Data unavailable	

II. RECENT RESEARCH AND SURVEY RESULTS

Otolith samples and length-frequency data of certain bottomfish species have been forwarded to NOAA Fisheries Honolulu Laboratory as part of a Team recommended project to assess bottomfish stocks in American Samoa. Analyses of these data have been postponed because of two position vacancies (a DMWR biologist and a NOAA Fisheries scientist); analyses will continue as soon as appropriate personnel arrangements are made.

III. HABITAT CONDITIONS AND RECENT ALTERATIONS

No surveys of the recovering reef areas in Manu'a that were affected by the January 1987 hurricane have been conducted.

IV. ENFORCEMENT ACTIVITIES AND PROBLEMS

Enforcement of new DMWR fishery regulations will commence after the completion of a public awareness program. Serious problems pertaining to the enforcement of the regulations are expected to be greatly minimized as a result of the program.

The Director of DMWR will distribute a memo to various local government agencies and the private sector, informing them of the new law prohibiting the disposal of plastics in the ocean.

V. NMFS ACTIONS

A Honolulu Laboratory scientist should be assigned to assist DMWR complete the Team recommended project to assess bottomfish stocks in American Samoa.

The DMWR supplied the Western Pacific Program Office with advice and comments on the environmental review of development projects. The DMWR also assisted with on-site surveys for these projects.

VI. STATE/TERRITORIAL MANAGEMENT ACTIONS

The DMWR is preparing a public awareness program aimed at educating the public about the newly adopted fishery regulations. This educational program, scheduled to begin in July 1989, will use all existing channels of the media to obtain extensive coverage and thereby reach as many individuals as possible in the public and private sectors.

VII. ASSESSMENT OF NEED FOR COUNCIL ACTION

The rudimentary analyses conducted on existing data for this report did not statistically document problems in the bottomfish fishery. There remain several significant deficiencies in our information base upon which conclusions can be drawn. Additional data are needed, data systems need to be improved, analyses need to be expanded and strengthened, and local expertise needs to be utilized more fully. Existing computer programs for summarizing and analyzing available data are insufficient to properly monitor the resource and describe the fishery. Assistance is needed to develop these tools to be used by the DMWR Team member in preparation of subsequent annual reports.

VIII. RECOMMENDATIONS FOR COUNCIL ACTION

1987 Team Recommendations

American Samoa now has a participant in the Team, actualizing the Team's first recommendation for Council action in the 1987 annual report. This person is also named to the Pelagic Team and is also American Samoa's coordinator for the WPACFIN program, thus facilitating the performance of Bottomfish and Pelagic Team functions. However, this new member should have been given a familiarization period of at least a year before being assigned the responsibility of producing the bottomfish annual report module for American Samoa.

The second recommendation by the Bottomfish Team in 1987 pointed out the need for "better species identification and acquisition of extensive size-frequency data." In 1988, DMWR's identification of bottomfish landings to the species level was the best on record. About 60% of the total bottomfish catch was

identified and recorded to the species level. The DMWR continued to collect length-frequency data from local stores during 1988.

The Team's third recommendation in 1987 for continuation of the DMWR-NMFS joint assessment of bottomfish stocks in American Samoa is being hindered by the recent resignation of DMWR and Honolulu Laboratory scientists who worked on this project.

In general, DMWR has acted favorably on the Team's 1987 recommendations.

1988 Recommendations

The Council should improve the selection process in determining suitable candidates for panels and Council members since some of those selected are sometimes non-cooperative with Council-related projects in their respective countries.

The DMWR should continue to improve the identification of bottomfish catches to the species level. A further 10% improvement is recommended for 1989.

A Honolulu Laboratory scientist should be assigned to work with DMWR biologists for the continuation of the joint project to assess bottomfish stocks in American Samoa.

To date, only visual interpretations have been used on the data. The fishery has undergone tremendous fluctuations. More thorough and statistically valid analyses should be performed on the data to determine whether trends or problems actually exist in this fishery. The Team should identify specific questions about the fishery; form hypotheses to answer these questions; determine analytical methods to test these hypotheses; provide guidelines for interpreting the analyses; and determine what constitutes trends, changes, or problems in the fishery. The Team should develop specific recommendations for format and content of the annual report modules. A special 2- to 5-day workshop should be held, possibly in concert with the Pelagic Team and select members of the Council's Scientific and Statistical Committee, to resolve these problems for all Council management areas.

Existing computer programs for summarizing and analyzing available data are insufficient to properly monitor the resource and describe the fishery. Assistance is needed to develop these tools to be used by the DMWR Team member in preparation of subsequent annual reports. It is recommended that the WPACFIN program complete the programming of the Bottomfish Team's annual report modules for American Samoa, preferably by November 1989, so that the DMWR can use portions of this module in preparing its government's 1989 annual report on the offshore fisheries, thereby eliminating the need to reproduce the same information using different formats.

REFERENCES

Aitaoto, F.
1988. Status of the Offshore Fisheries in American Samoa. Department of Marine and Wildlife Resources, Annual Report.

Hamm, D. C. and T. T. Kassman.
1986. Fishery statistics of the western Pacific, volume I. American Samoa (1982-84), Commonwealth of the Northern Mariana Islands (1979-84), State of Hawaii (1987). Southwest Fisheries Center . Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-86-4, var. pag.

Hamm, D. C., and M. M. C. Quach.
1988a. Bottomfish fisheries of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-88-15, 76 p.

1988b. Fishery statistics of the western Pacific, volume III. Territory of American Samoa (1985-86), Commonwealth of the Northern Mariana Islands (1985-86), Territory of Guam (1985-86), State of Hawaii (1985-86). Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-88-4, var. pag.

1989. Fishery statistics of the western Pacific, volume IV. Territory of American Samoa (1987), Commonwealth of the Northern Mariana Islands (1987), Territory of Guam (1987) State of Hawaii (1987). Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-89-1, var. pag.

Western Pacific Regional Fishery Management Council (Council).
1988. 1987 Western Pacific Regional Fishery Management Council annual report for the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Western Pacific Regional Fishery Management Council, 1164 Bishop Street, Honolulu, HI 96813, var. pag.

1988. 1986 Western Pacific Regional Fishery Management Council annual report for the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Western Pacific Regional Fishery Management Council, 1164 Bishop Street, Honolulu, HI 96813, var. pag.

APPENDIX A: TABLES

Table 1

AMERICAN SAMOA 1988 ANNUAL ESTIMATED COMMERCIAL BOTTOMFISH LANDINGS

Species	Pounds	Value	$/lb
JACKS	706	1,115	1.58
BLACK JACK	1,976	3,471	1.76
WHITEMOUTH TREVALLY	50	75	1.50
BOTTOMFISH	24,570	37,273	1.52
GROUPERS	885	1,371	1.55
PEACOCK GROUPER	643	1,039	1.62
FLAGTAIL GROUPER	670	1,047	1.56
STRIPED GROUPER	51	84	1.65
SPOTTED GROUPER	273	450	1.65
GIANT GROUPER	45	72	1.60
LUNARTAIL GROUPER	2,800	4,431	1.58
BLUE LINED SNAPPER	6,712	11,284	1.68
ONESPOT SNAPPER	13	20	1.54
TWINSPOT/RED SNAPPER	82	111	1.35
HUMPBACK SNAPPER	666	1,111	1.67
BLOOD SNAPPER	180	291	1.62
BROWN JOBFISH	231	383	1.66
GRAY JOBFISH	1,244	2,070	1.66
DEEPWATER BOTTOMFISH	619	1,006	1.63
OPAKAPAKA	1,012	1,671	1.65
GINDAI (FLOWER SNAP)	495	812	1.64
LEHI (SILVERJAW)	2,276	4,487	1.97
ONAGA (RED SNAPPER)	1,820	3,684	2.02
EHU (RED SNAPPER)	2,076	3,897	1.88
STONE'S SNAPPER	288	559	1.94
BIGEYE EMPEROR	157	251	1.60
EMPERORS (MISC)	554	933	1.69
LONGNOSE EMPEROR	3,736	6,076	1.63
AMBON EMPEROR	1,166	1,856	1.59
BLUELINE BREAM	133	219	1.65
ORANGESPOT EMPEROR	457	757	1.66
REDGILL EMPEROR	3,225	5,338	1.66
** Total Bottomfish **	59,810	97,244	1.63
** TOTAL ALL SPECIES**	281,036	325,415	1.16

Table 2

AMERICAN SAMOA 1988 MONTHLY ESTIMATED COMMERCIAL BOTTOMFISH LANDINGS

Species	Pounds	Value	$/lb
** January **			
JACKS	23	32	1.39
BOTTOMFISH	5,688	7,708	1.36
GROUPERS	35	54	1.54
LUNARTAIL GROUPER	5	6	1.20
BLUE LINED SNAPPER	54	86	1.59
TWINSPOT/RED SNAPPER	12	16	1.33
GRAY JOBFISH	89	159	1.79
LONGNOSE EMPEROR	145	218	1.50
** Total Bottomfish **	6,051	8,279	1.37
** TOTAL ALL SPECIES**	24,575	33,458	1.36
** February **			
JACKS	353	554	1.57
BLACK JACK	128	212	1.66
BOTTOMFISH	12,363	19,162	1.55
FLAGTAIL GROUPER	92	152	1.65
BLUE LINED SNAPPER	308	472	1.54
HUMPBACK SNAPPER	19	23	1.25
BLOOD SNAPPER	180	291	1.62
BROWN JOBFISH	231	383	1.66
OPAKAPAKA	287	473	1.65
ONAGA (RED SNAPPER)	60	120	2.00
EMPERORS (MISC)	100	151	1.51
AMBON EMPEROR	458	760	1.66
ORANGESPOT EMPEROR	132	219	1.66
REDGILL EMPEROR	56	70	1.25
** Total Bottomfish **	14,766	23,043	1.56
** TOTAL ALL SPECIES**	40,241	50,469	1.25
** March **			
BLACK JACK	159	283	1.78
BOTTOMFISH	5,207	8,569	1.65
GROUPERS	62	102	1.65
PEACOCK GROUPER	16	27	1.69
LUNARTAIL GROUPER	91	146	1.60
BLUE LINED SNAPPER	344	553	1.61
HUMPBACK SNAPPER	125	213	1.70
OPAKAPAKA	153	252	1.65
LEHI (SILVERJAW)	125	246	1.97
ONAGA (RED SNAPPER)	59	122	2.07
LONGNOSE EMPEROR	146	235	1.61
REDGILL EMPEROR	700	1,127	1.61
** Total Bottomfish **	7,187	11,875	1.65
** TOTAL ALL SPECIES**	22,399	34,712	1.55

Table 2 (Cont.)

AMERICAN SAMOA 1988 MONTHLY ESTIMATED COMMERCIAL BOTTOMFISH LANDINGS

Species	Pounds	Value	$/lb
** April **			
BLACK JACK	65	104	1.60
BOTTOMFISH	144	180	1.25
PEACOCK GROUPER	231	371	1.61
LUNARTAIL GROUPER	58	88	1.52
BLUE LINED SNAPPER	825	1,270	1.54
ONESPOT SNAPPER	13	20	1.54
HUMPBACK SNAPPER	91	146	1.60
GRAY JOBFISH	211	322	1.53
LEHI (SILVERJAW)	120	193	1.61
ONAGA (RED SNAPPER)	19	30	1.58
STONE'S SNAPPER	32	51	1.59
BIGEYE EMPEROR	10	16	1.60
LONGNOSE EMPEROR	162	259	1.60
REDGILL EMPEROR	682	1,050	1.54
** Total Bottomfish **	2,663	4,100	1.54
** TOTAL ALL SPECIES**	13,391	21,011	1.57
** May **			
BLACK JACK	330	648	1.96
BOTTOMFISH	88	109	1.25
PEACOCK GROUPER	103	232	2.25
LUNARTAIL GROUPER	83	129	1.55
BLUE LINED SNAPPER	703	1,296	1.84
HUMPBACK SNAPPER	89	141	1.58
LEHI (SILVERJAW)	979	2,095	2.14
ONAGA (RED SNAPPER)	914	1,910	2.09
EHU (RED SNAPPER)	611	1,341	2.20
REDGILL EMPEROR	670	1,232	1.84
** Total Bottomfish **	4,569	9,132	2.00
** TOTAL ALL SPECIES**	11,762	18,392	1.53

Table 2 (Cont.)

AMERICAN SAMOA 1988 MONTHLY ESTIMATED COMMERCIAL BOTTOMFISH LANDINGS

Species	Pounds	Value	$/lb
** June **			
WHITEMOUTH TREVALLY	50	75	1.50
GROUPERS	105	169	1.61
PEACOCK GROUPER	73	125	1.71
FLAGTAIL GROUPER	217	329	1.52
LUNARTAIL GROUPER	249	373	1.50
BLUE LINED SNAPPER	630	927	1.47
GRAY JOBFISH	119	179	1.50
DEEPWATER BOTTOMFISH	44	66	1.50
LEHI (SILVERJAW)	263	515	1.96
ONAGA (RED SNAPPER)	193	397	2.06
EHU (RED SNAPPER)	610	945	1.55
BIGEYE EMPEROR	147	235	1.60
LONGNOSE EMPEROR	512	773	1.51
AMBON EMPEROR	203	304	1.50
** Total Bottomfish **	3,415	5,412	1.58
** TOTAL ALL SPECIES**	28,830	27,675	0.96
** July **			
BLACK JACK	189	308	1.63
BOTTOMFISH	1,081	1,545	1.43
GROUPERS	95	136	1.43
LUNARTAIL GROUPER	27	43	1.59
BLUE LINED SNAPPER	258	420	1.63
GRAY JOBFISH	31	46	1.48
LEHI (SILVERJAW)	153	246	1.61
EHU (RED SNAPPER)	119	238	2.00
LONGNOSE EMPEROR	506	819	1.62
REDGILL EMPEROR	163	270	1.66
** Total Bottomfish **	2,622	4,071	1.55
** TOTAL ALL SPECIES**	23,543	21,191	0.90

Table 2 (Cont.)

AMERICAN SAMOA 1988 MONTHLY ESTIMATED COMMERCIAL BOTTOMFISH LANDINGS

Species	Pounds	Value	$/lb
** August **			
JACKS	133	211	1.58
BLACK JACK	88	176	2.00
GROUPERS	88	136	1.55
PEACOCK GROUPER	133	134	1.01
SPOTTED GROUPER	273	450	1.65
GIANT GROUPER	45	72	1.60
LUNARTAIL GROUPER	522	817	1.56
BLUE LINED SNAPPER	1,120	2,022	1.81
TWINSPOT/RED SNAPPER	70	95	1.36
HUMPBACK SNAPPER	119	206	1.74
GRAY JOBFISH	137	275	2.01
DEEPWATER BOTTOMFISH	519	856	1.65
GINDAI (FLOWER SNAP)	56	84	1.50
LEHI (SILVERJAW)	221	444	2.01
ONAGA (RED SNAPPER)	161	262	1.63
EHU (RED SNAPPER)	181	272	1.50
STONE'S SNAPPER	239	478	2.00
EMPERORS (MISC)	19	28	1.50
LONGNOSE EMPEROR	701	1,254	1.79
** Total Bottomfish **	4,825	8,272	1.71
** TOTAL ALL SPECIES**	28,743	26,910	0.94
** September **			
BLACK JACK	50	100	2.00
GROUPERS	338	523	1.55
LUNARTAIL GROUPER	643	1,009	1.57
BLUE LINED SNAPPER	588	1,181	2.01
HUMPBACK SNAPPER	33	66	2.00
GRAY JOBFISH	27	54	2.00
OPAKAPAKA	300	495	1.65
EHU (RED SNAPPER)	300	594	1.98
STONE'S SNAPPER	17	30	1.76
EMPERORS (MISC)	60	120	2.00
LONGNOSE EMPEROR	440	712	1.62
BLUELINE BREAM	133	219	1.65
ORANGESPOT EMPEROR	50	82	1.64
REDGILL EMPEROR	331	549	1.66
** Total Bottomfish **	3,310	5,734	1.73
** TOTAL ALL SPECIES**	18,352	16,036	0.87

Table 2 (Cont.)

AMERICAN SAMOA 1988 MONTHLY ESTIMATED COMMERCIAL BOTTOMFISH LANDINGS

Species	Pounds	Value	$/lb
** October **			
JACKS	85	141	1.66
BLACK JACK	280	464	1.66
GROUPERS	51	79	1.55
STRIPED GROUPER	51	84	1.65
LUNARTAIL GROUPER	352	584	1.66
BLUE LINED SNAPPER	205	330	1.61
HUMPBACK SNAPPER	17	28	1.65
GRAY JOBFISH	229	382	1.67
LEHI (SILVERJAW)	221	366	1.66
ONAGA (RED SNAPPER)	189	378	2.00
EHU (RED SNAPPER)	123	246	2.00
EMPERORS (MISC)	44	72	1.64
LONGNOSE EMPEROR	528	839	1.59
ORANGESPOT EMPEROR	275	456	1.66
** Total Bottomfish **	2,650	4,449	1.68
** TOTAL ALL SPECIES**	20,696	21,510	1.04
** November **			
JACKS	112	178	1.58
BLACK JACK	270	434	1.61
GROUPERS	111	172	1.55
PEACOCK GROUPER	87	150	1.72
FLAGTAIL GROUPER	215	337	1.57
LUNARTAIL GROUPER	492	800	1.63
BLUE LINED SNAPPER	1,232	1,998	1.62
HUMPBACK SNAPPER	69	111	1.61
GRAY JOBFISH	401	653	1.63
DEEPWATER BOTTOMFISH	56	84	1.50
OPAKAPAKA	272	451	1.66
GINDAI (FLOWER SNAP)	439	728	1.66
LEHI (SILVERJAW)	194	382	1.97
ONAGA (RED SNAPPER)	225	465	2.07
LONGNOSE EMPEROR	436	710	1.63
AMBON EMPEROR	505	792	1.57
REDGILL EMPEROR	623	1,040	1.67
** Total Bottomfish **	5,739	9,485	1.65
** TOTAL ALL SPECIES**	22,863	30,945	1.53

Table 2 (Cont.)

AMERICAN SAMOA 1988 MONTHLY ESTIMATED COMMERCIAL BOTTOMFISH LANDINGS

Species	Pounds	Value	$/lb
** December **			
BLACK JACK	417	742	1.78
FLAGTAIL GROUPER	146	229	1.57
LUNARTAIL GROUPER	278	436	1.57
BLUE LINED SNAPPER	445	729	1.64
HUMPBACK SNAPPER	104	177	1.70
EHU (RED SNAPPER)	132	261	1.98
EMPERORS (MISC)	331	562	1.70
LONGNOSE EMPEROR	160	257	1.61
** Total Bottomfish **	2,013	3,393	1.69
** TOTAL ALL SPECIES**	25,643	23,107	0.90

Table 3

American Samoa Bottomfish Catch and Effort

	1982	1983	1984	1985	1986	1987	1988
Estimated Number of Bottomfish Trips	594	652	662	873	738	233	269
Number of Vessels Landing Bottomfish	21	26	35	46	33	18	20
Average Bottomfish Trip Length (hrs)	13.5	17.6	14.7	14.6	15.3	11.3	10.3
Average Catch per Hour	8.2	11.1	9.9	8.0	9.2	12.4	17.5

Table 4

Percent of Bottomfish Catch by Area

Area	1982	1983	1984	1985	1986	1987	1988
2	0	2.3	1.4	3.1	0.5	0	1.2
3	1.3	1.3	8.9	8.4	6.5	4.2	0
4	0	0	0.4	0	5.6	0	3.2
9	0	5.7	15.5	11.8	14.2	3.9	8.4
10	0	0.1	3.7	2.2	8.0	10.8	6.4
11	0	0	0.9	0	0	0	0
12	0	10.7	2.4	0.2	6.9	3.6	11.3
20	0	0	0	0.3	0	0	0
31	3.4	15.9	25.6	23.0	7.4	11.1	8.1
32	2.6	7.9	4.6	16.2	5.5	3.6	12.9
33	49.2	15.7	3.1	8.8	15.1	40.3	11.2
34	3.1	4.7	6.5	2.3	2.6	12.6	8.3
35	31.8	9.8	1.6	1.3	6.2	0	5.1
36	8.6	22.8	25.1	18.6	17.4	9.9	19.6
41	0	0.7	0	0	0	0	2.3
42	0	2.0	0.3	0.3	0	0	0
43	0	0.2	0	3.4	2.4	0	0
44	0	0	0	0	1.2	0	0
45	0	0	0	0	0.6	0	2.1

Table 5

AMERICAN SAMOA BOTTOMFISH LANDINGS
(UNALLOCATED MISCELLANEOUS BOTTOMFISH)

SPECIES %	1982	1983	1984	1985	1986	1987	1988
Jacks	139	1962	1909	467	615	94	706
	0.22%	1.57%	2.06%	0.47%	0.62%	0.32%	1.18%
Amberjack	0	111	0	0	0	0	0
	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%
Black Jack	20	151	15	80	388	33	1976
	0.03%	0.12%	0.02%	0.08%	0.39%	0.11%	3.30%
Trevally	0	0	14	[illegible]	0	0	0
	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%
Bigeye Trevally	0	19	0	95	0	0	0
	0.00%	0.02%	0.00%	0.10%	0.00%	0.00%	0.00%
Bluefin Trevally	0	6	0	0	0	0	0
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Whitemouth Trevally	0	0	0	0	0	0	50
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%
Groupers	141	1705	1510	173	128	14	885
	0.23%	1.36%	1.63%	0.17%	0.13%	0.05%	1.48%
Blacktip Grouper	0	6	10	13	0	0	0
	0.00%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
Flagtail Grouper	10	4	0	0	0	0	670
	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	1.12%
Giant Grouper	282	348	243	0	0	0	45
	0.45%	0.28%	0.26%	0.00%	0.00%	0.00%	0.08%
Lunartail Grouper	504	198	564	397	232	34	2800
	0.81%	0.16%	0.61%	0.40%	0.24%	0.11%	4.68%
Peacock Grouper	0	0	0	0	0	0	643
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.08%
Spotted Grouper	0	0	0	0	0	0	273
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%
Striped Grouper	0	22	0	0	0	0	51
	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.09%
Tomato Grouper	0	167	0	196	157	27	0
	0.00%	0.13%	0.00%	0.20%	0.16%	0.09%	0.00%
Snappers	0	52	128	43	126	0	0
	0.00%	0.04%	0.14%	0.04%	0.13%	0.00%	0.00%
Black Snapper	0	0	40	27	0	0	0
	0.00%	0.00%	0.04%	0.03%	0.00%	0.00%	0.00%
Blacktail Snapper	0	111	546	51	0	0	0
	0.00%	0.09%	0.59%	0.05%	0.00%	0.00%	0.00%
Blood Snapper	0	0	0	0	0	0	180
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.30%
Blue Lined Snapper	1209	2973	3713	553	340	150	6712
	1.95%	2.38%	4.00%	0.56%	0.35%	0.51%	11.22%
Humpback Snapper	561	1174	1698	269	167	34	666
	0.90%	0.94%	1.83%	0.27%	0.17%	0.11%	1.11%
Kusakar's Snapper	0	25	108	18	0	0	0
	0.00%	0.02%	0.12%	0.02%	0.00%	0.00%	0.00%
Onespot Snapper	7	342	381	57	98	7	13
	0.01%	0.27%	0.41%	0.06%	0.10%	0.02%	0.02%

Table 5 (Cont.)

SPECIES %	1982	1983	1984	1985	1986	1987	1988
Rufous Snapper	0	0	122	0	0	0	0
	0.00%	0.00%	0.13%	0.00%	0.00%	0.00%	0.00%
Stone's Snapper	0	2039	834	143	0	0	288
	0.00%	1.63%	0.90%	0.14%	0.00%	0.00%	0.48%
Twinspot/Red Snapper	0	259	585	7	47	0	82
	0.00%	0.21%	0.63%	0.01%	0.05%	0.00%	0.14%
Yellowtail Snapper	0	13	3	5	0	0	0
	0.00%	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%
Brown Jobfish	0	52	0	0	0	0	231
	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.39%
Gray Jobfish	230	5943	1521	534	315	25	1244
	0.37%	4.75%	1.64%	0.54%	0.32%	0.08%	2.08%
Yellow Opakapaka	40	1618	1193	522	490	52	0
	0.06%	1.29%	1.28%	0.53%	0.50%	0.18%	0.00%
Hawaiian Opakapaka	68	173	1043	456	342	0	0
	0.11%	0.14%	1.12%	0.46%	0.35%	0.00%	0.00%
Opakapaka	406	0	40	168	0	0	1012
	0.65%	0.00%	0.04%	0.17%	0.00%	0.00%	1.69%
Blue Lined Gindai	13	0	0	125	0	0	0
	0.02%	0.00%	0.00%	0.13%	0.00%	0.00%	0.00%
Gindai	82	918	1729	1211	568	38	495
	0.13%	0.73%	1.86%	1.22%	0.58%	0.13%	0.83%
Lehi	216	4512	1227	396	666	81	2276
	0.35%	3.60%	1.32%	0.40%	0.68%	0.27%	3.81%
Onaga	1002	13738	4282	2139	3921	232	1820
	1.62%	10.98%	4.61%	2.16%	3.98%	0.78%	3.04%
Ehu	1345	5808	4291	4382	4177	298	2076
	2.17%	4.64%	4.62%	4.42%	4.24%	1.01%	3.47%
Emperors	2910	3253	3747	730	119	16	554
	4.69%	2.60%	4.04%	0.74%	0.12%	0.05%	0.93%
Ambon Emperor	0	0	0	0	0	65	1166
	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	1.95%
Bigeye Emperor	0	0	0	0	0	0	157
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.26%
Longnose Emperor	150	65	111	80	0	0	3736
	0.24%	0.05%	0.12%	0.08%	0.00%	0.00%	6.25%
Orangespot Emperor	0	0	0	0	0	0	457
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.76%
Redgill Emperor	0	0	0	0	0	0	3225
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.39%
Bluelined Bream	21	0	0	0	0	0	133
	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%
Snake Mackerel	17	41	8	0	0	0	0
	0.03%	0.03%	0.01%	0.00%	0.00%	0.00%	0.00%
Deepwater Bottomfish	2349	0	163	649	1157	0	619
	3.79%	0.00%	0.18%	0.65%	1.18%	0.00%	1.03%
Bottomfish	50294	77359	61063	85230	84384	28425	24570
	81.10%	61.80%	65.77%	85.90%	85.72%	95.95%	41.08%
TOTAL:	62016	125167	92841	99216	98437	29625	59811

Table 6

AMERICAN SAMOA BOTTOMFISH LANDINGS
(ALLOCATED MISCELLANEOUS BOTTOMFISH)

SPECIES %	1982	1983	1984	1985	1986	1987	1988
Jacks	885	5137	5596	3451	4639	2321	1207
	1.43%	4.10%	6.03%	3.48%	4.71%	7.83%	2.02%
Amberjack	0	291	0	0	0	0	0
	0.00%	0.23%	0.00%	0.00%	0.00%	0.00%	0.00%
Black Jack	127	395	44	591	2927	815	3378
	0.21%	0.32%	0.05%	0.60%	2.97%	2.75%	5.65%
Trevally	0	0	41	0	0	0	0
	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%
Bigeye Trevally	0	50	0	702	0	0	0
	0.00%	0.04%	0.00%	0.71%	0.00%	0.00%	0.00%
Bluefin Trevally	0	16	0	0	0	0	0
	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Whitemouth Trevally	0	0	0	0	0	0	85
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.14%
Groupers	898	4464	4426	1279	966	346	1513
	1.45%	3.57%	4.77%	1.29%	0.98%	1.17%	2.53%
Blacktip Grouper	0	16	29	96	0	0	0
	0.00%	0.01%	0.03%	0.10%	0.00%	0.00%	0.00%
Flagtail Grouper	64	10	0	0	0	0	1145
	0.10%	0.01%	0.00%	0.00%	0.00%	0.00%	1.92%
Giant Grouper	1795	911	712	0	0	0	77
	2.89%	0.73%	0.77%	0.00%	0.00%	0.00%	0.13%
Lunartail Grouper	3208	518	1653	2934	1750	839	4787
	5.17%	0.41%	1.78%	2.96%	1.78%	2.83%	8.00%
Peacock Grouper	0	0	0	0	0	0	1099
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.84%
Spotted Grouper	0	0	0	0	0	0	467
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.78%
Striped Grouper	0	58	0	0	0	0	87
	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.15%
Tomato Grouper	0	437	0	1449	1184	667	0
	0.00%	0.35%	0.00%	1.46%	1.20%	2.25%	0.00%
Snappers	0	136	375	318	950	0	0
	0.00%	0.11%	0.40%	0.32%	0.97%	0.00%	0.00%
Black Snapper	0	0	117	200	0	0	0
	0.00%	0.00%	0.13%	0.20%	0.00%	0.00%	0.00%
Blacktail Snapper	0	291	1601	377	0	0	0
	0.00%	0.23%	1.72%	0.38%	0.00%	0.00%	0.00%
Blue Lined Snapper	7696	7784	10884	4087	2565	3703	11475
	12.41%	6.22%	11.72%	4.12%	2.61%	12.50%	19.19%
Blood Snapper	0	0	0	0	0	0	308
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.51%
Humpback Snapper	3571	3074	4978	1988	1260	839	1139
	5.76%	2.46%	5.36%	2.00%	1.28%	2.83%	1.90%
Kusakar's Snapper	0	65	317	133	0	0	0
	0.00%	0.05%	0.34%	0.13%	0.00%	0.00%	0.00
Onespot Snapper	45	895	1117	421	739	173	22
	0.07%	0.72%	1.20%	0.42%	0.75%	0.58%	0.04%

Table 6 (Cont.)

SPECIES %	1982	1983	1984	1985	1986	1987	1988
Rufous Snapper	0	0	358	0	0	0	0
	0.00%	0.00%	0.39%	0.00%	0.00%	0.00%	0.00%
Stone's Snapper	0	5338	2445	1057	0	0	492
	0.00%	4.26%	2.63%	1.07%	0.00%	0.00%	0.82%
Twinspot/Red Snapper	0	678	1715	52	355	0	140
	0.00%	0.54%	1.85%	0.05%	0.36%	0.00%	0.23%
Yellowtail Snapper	0	34	9	37	0	0	0
	0.00%	0.03%	0.01%	0.04%	0.00%	0.00%	0.00%
Brown Jobfish	0	136	0	0	0	0	395
	0.00%	0.11%	0.00%	0.00%	0.00%	0.00%	0.66%
Gray Jobfish	1464	15559	4459	3947	2376	617	2127
	2.36%	12.43%	4.80%	3.98%	2.41%	2.08%	3.56%
Yellow Opakapaka	284	4236	3511	3894	3752	1284	0
	0.46%	3.38%	3.78%	3.92%	3.81%	4.33%	0.00%
Hawaiian Opakapaka	483	453	3070	3402	2619	0	0
	0.78%	0.36%	3.31%	3.43%	2.66%	0.00%	0.00%
Opakapaka	2885	0	118	1253	0	0	1812
	4.65%	0.00%	0.13%	1.26%	0.00%	0.00%	3.03%
Blue Lined Gindai	92	0	0	932	0	0	0
	0.15%	0.00%	0.00%	0.94%	0.00%	0.00%	0.00%
Gindai	583	2403	5089	9033	4349	938	886
	0.94%	1.92%	5.48%	9.10%	4.42%	3.17%	1.48%
Lehi	1535	11813	3611	2954	5100	2000	4075
	2.48%	9.44%	3.89%	2.98%	5.18%	6.75%	6.81%
Onaga	7121	35968	12603	15956	30024	5728	3258
	11.48%	28.74%	13.57%	16.08%	30.50%	19.33%	5.45%
Ehu	9558	15206	12630	32688	31984	7357	3717
	15.41%	12.15%	13.60%	32.95%	32.49%	24.83%	6.21%
Emperors	18525	8517	10984	5395	898	395	947
	29.87%	6.80%	11.83%	5.44%	0.91%	1.33%	1.58%
Ambon Emperor	0	0	0	0	0	1605	1993
	0.00%	0.00%	0.00%	0.00%	0.00%	5.42%	3.33%
Bigeye Emperor	0	0	0	0	0	0	268
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.45%
Longnose Emperor	955	170	325	591	0	0	6387
	1.54%	0.14%	0.35%	0.60%	0.00%	0.00%	10.68%
Orangespot Emperor	0	0	0	0	0	0	781
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.31%
Redgill Emperor	0	0	0	0	0	0	5514
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	9.22%
Bluelined Bream	134	0	0	0	0	0	227
	0.22%	0.00%	0.00%	0.00%	0.00%	0.00%	0.38%
Snake Mackerel	108	107	23	0	0	0	0
	0.17%	0.09%	0.03%	0.00%	0.00%	0.00%	0.00%
TOTAL:	62016	125167	92841	99216	98437	29625	59811

APPENDIX B: FIGURES

Figure 1

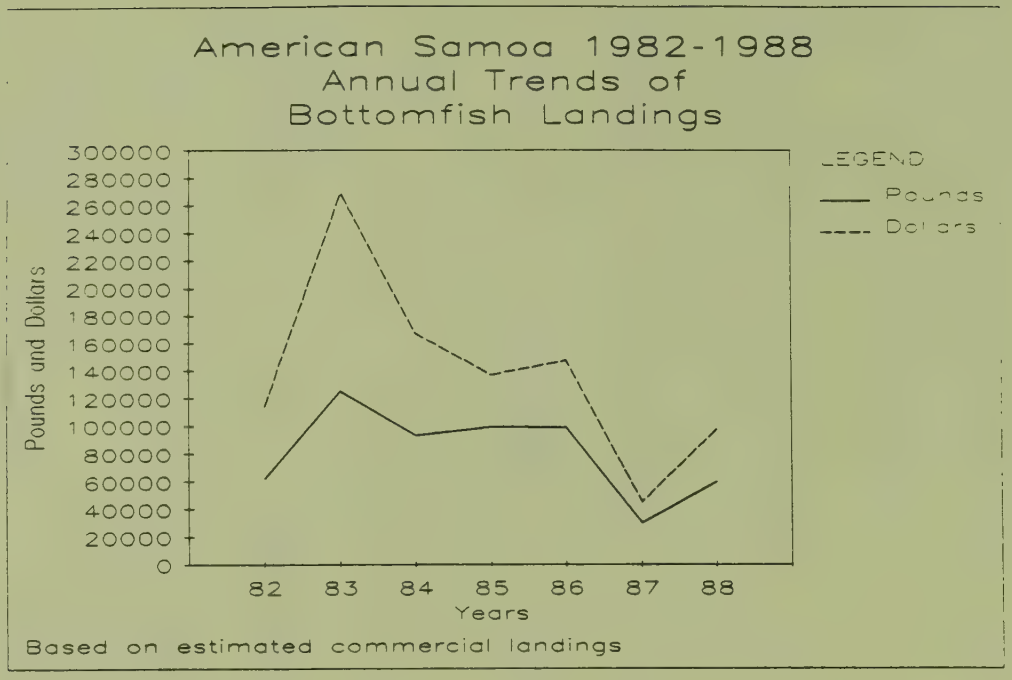


Figure 2

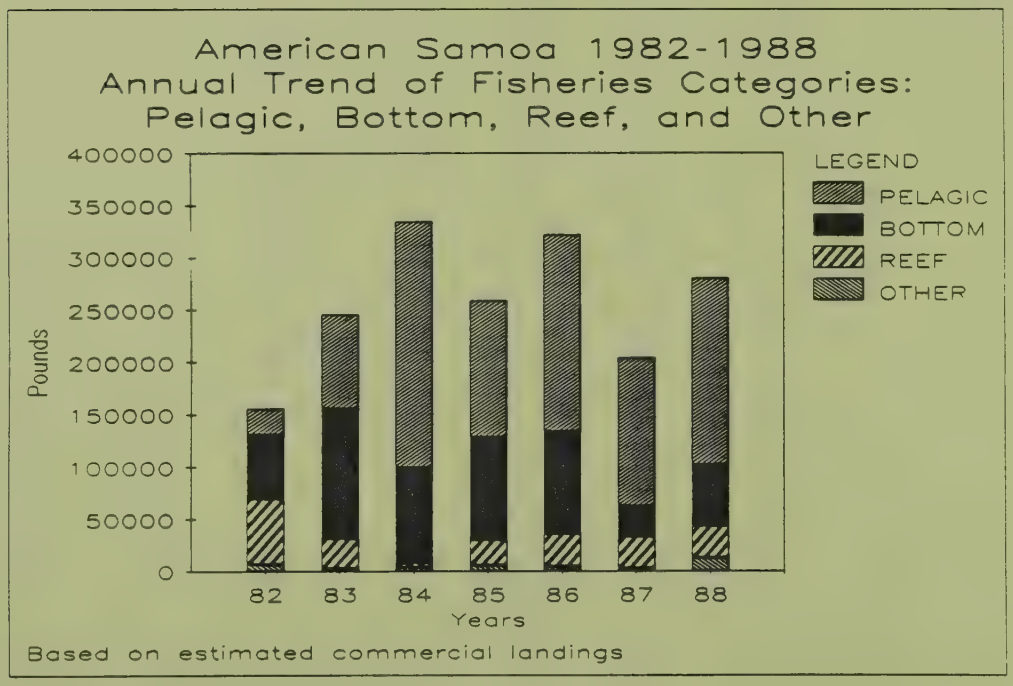


Figure 3

Figure 4

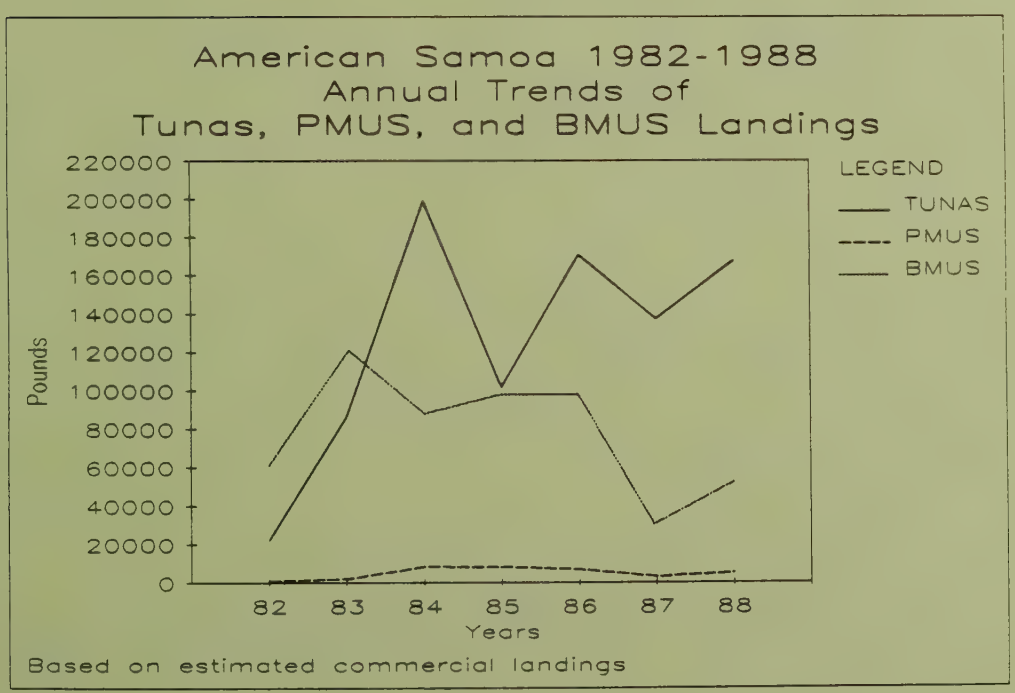


Figure 5

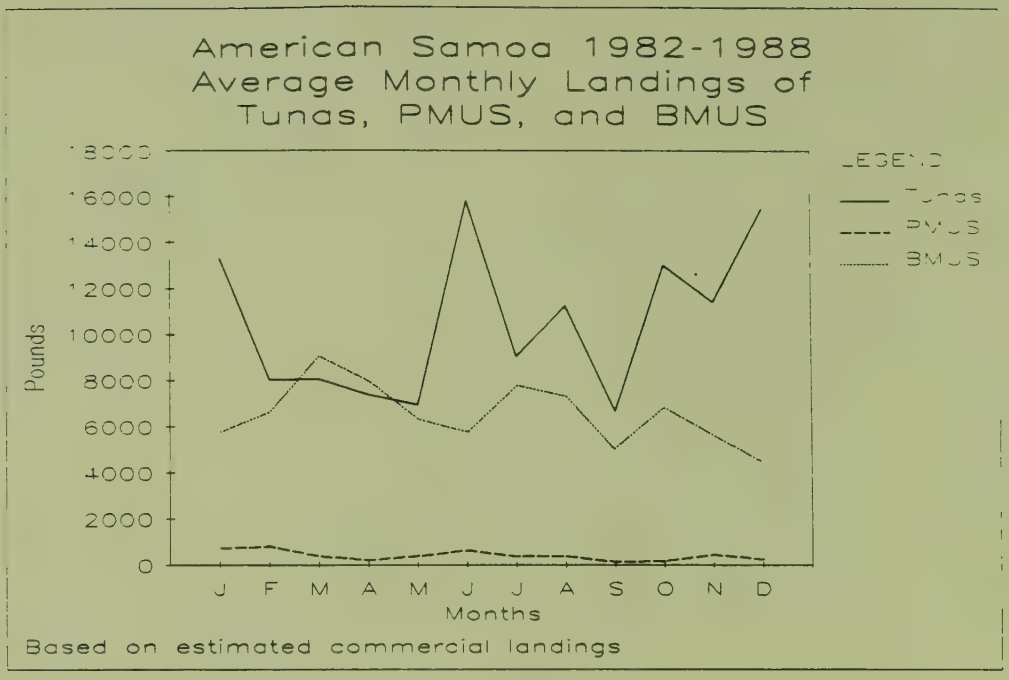


Figure 6

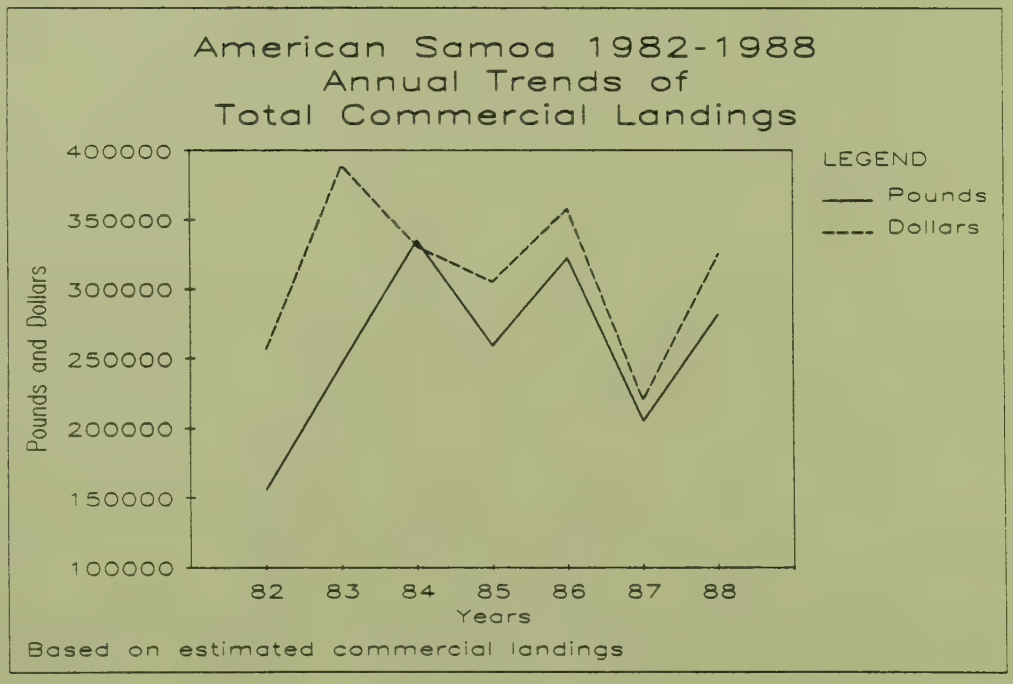


Figure 7

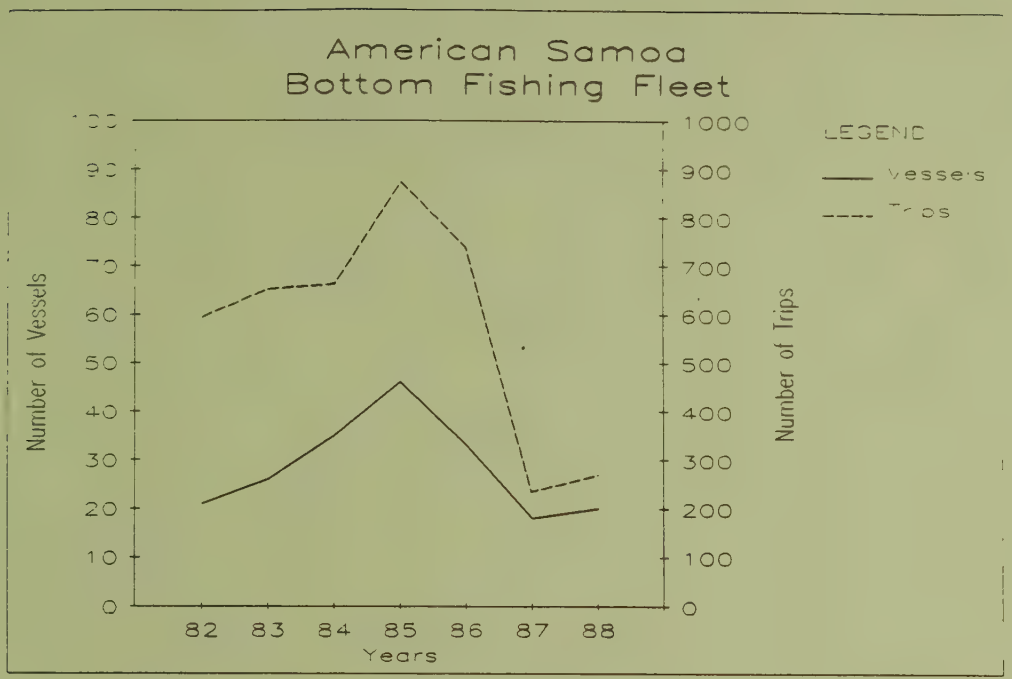
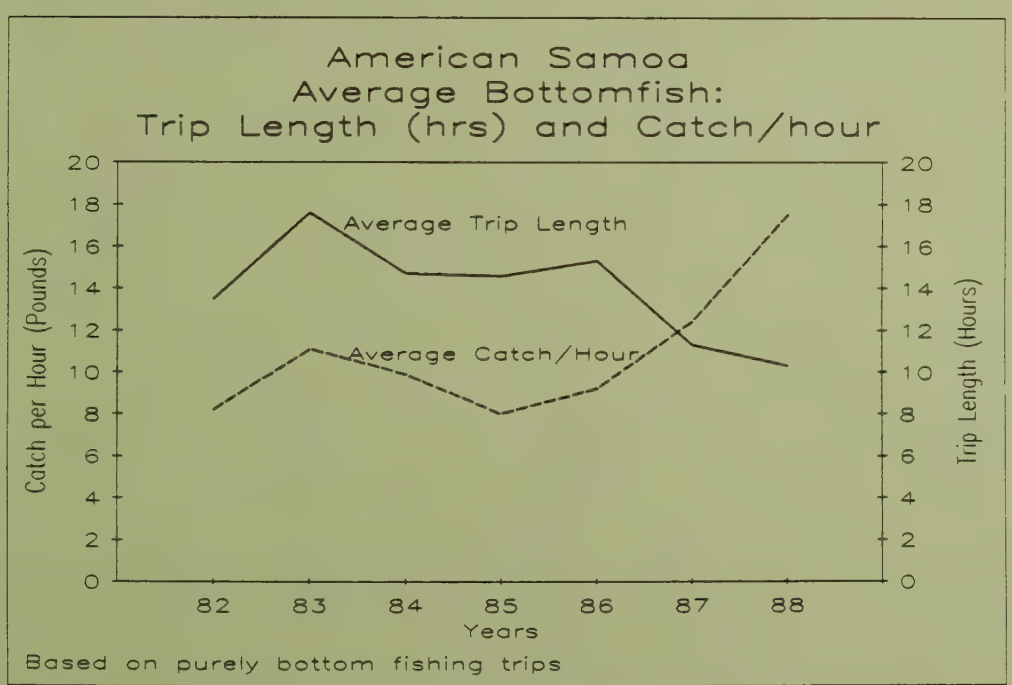
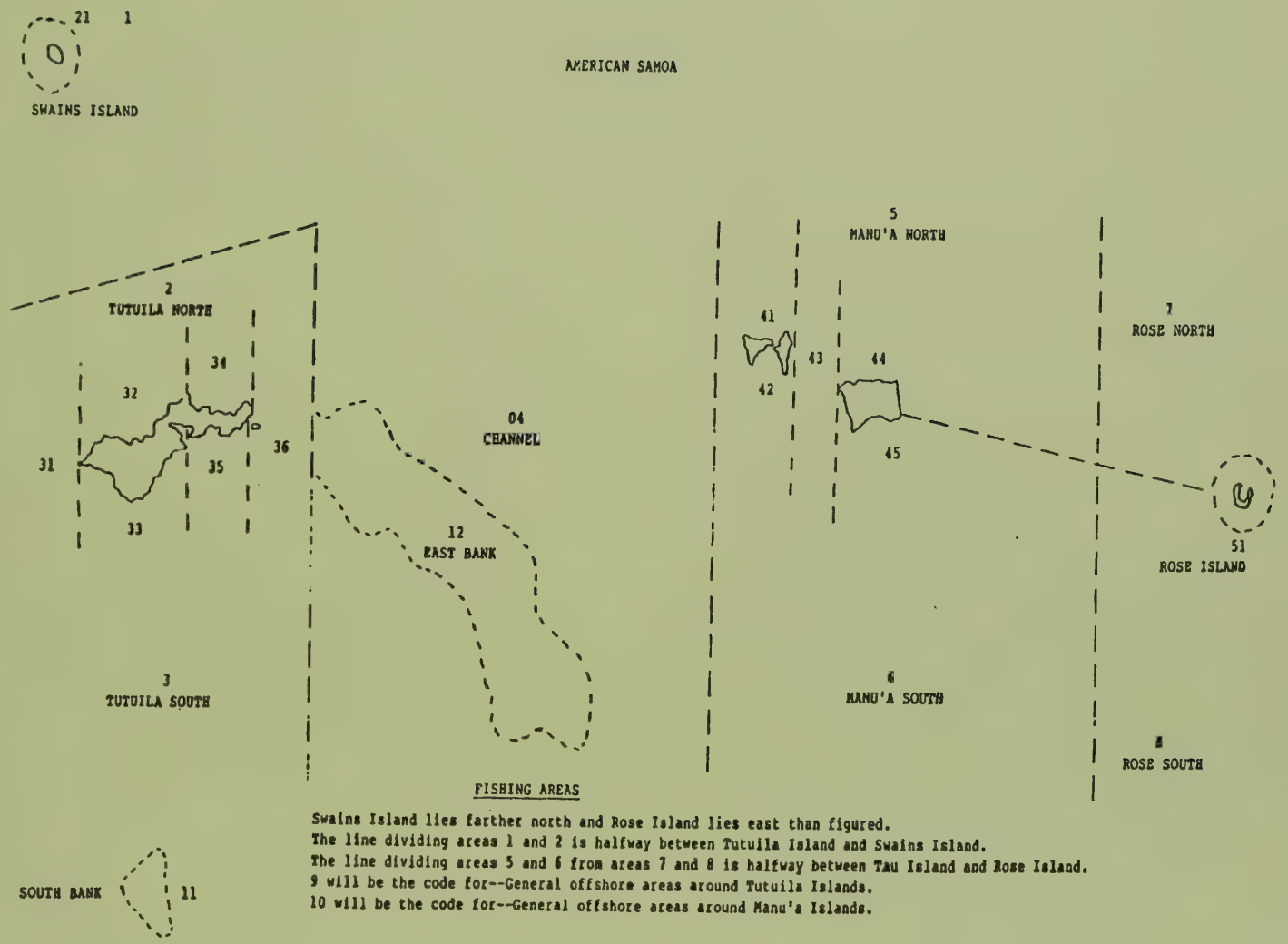


Figure 8





Swains Island lies farther north and Rose Island lies east than figured.
The line dividing areas 1 and 2 is halfway between Tutuila Island and Swains Island.
The line dividing areas 5 and 6 from areas 7 and 8 is halfway between Tau Island and Rose Island.
9 will be the code for--General offshore areas around Tutuila Islands.
10 will be the code for--General offshore areas around Manu'a Islands.

Figure 9

Figure 10

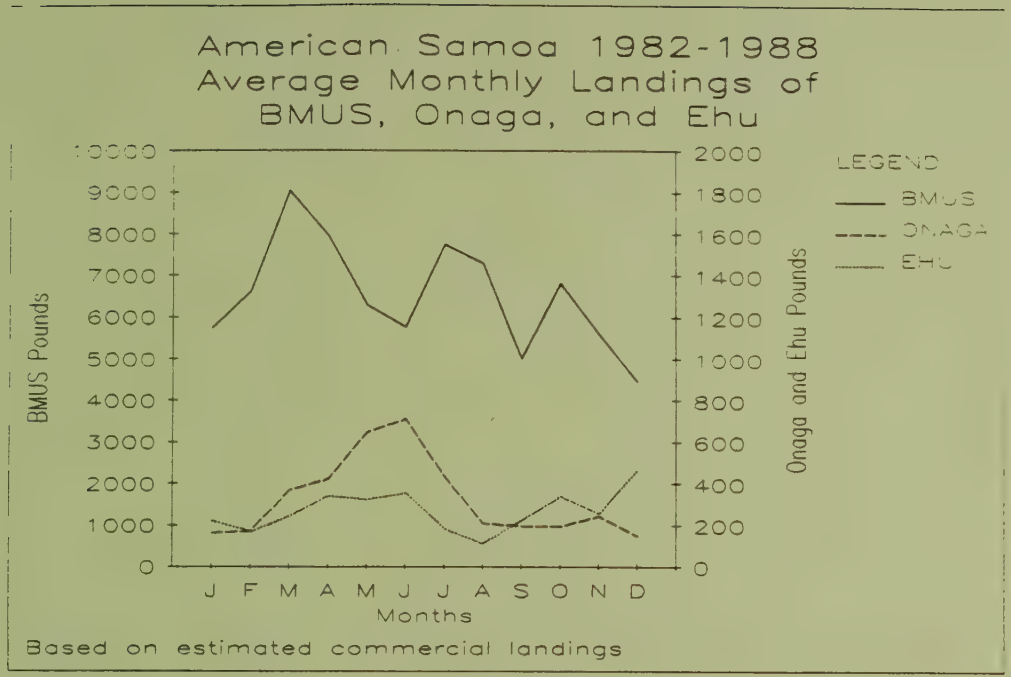


Figure 11

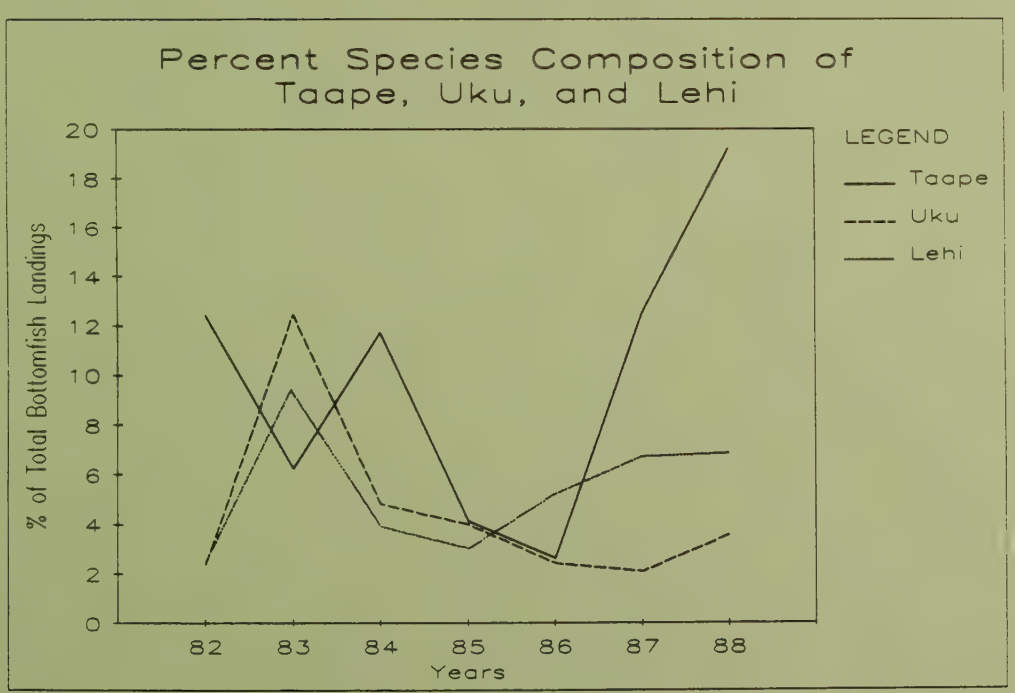
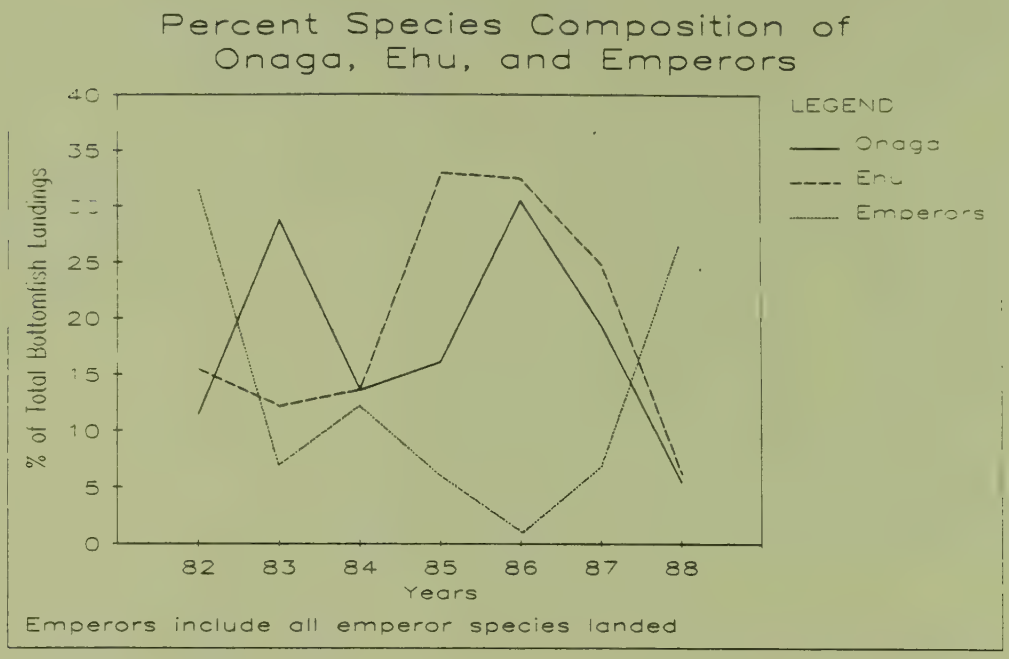


Figure 12


Percent Species Composition of
Onaga, Ehu, and Emperors
% of Total Bottomfish Landings
40
35
30
25
20
15
10
5
0
82
83
84
85
86
87
88
Years
LEGEND
Onaga
Ehu
Emperors
Emperors include all emperor species landed

APPENDIX 4

ANNUAL REPORT FOR THE 1988 BOTTOMFISH FISHERY

OF THE

TERRITORY OF GUAM

JUNE 1989

Prepared By

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FOR THE

Western Pacific Regional Fishery Management Council's

BOTTOMFISH PLAN MONITORING TEAM

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INTRODUCTION

The Fishery Management Plan (FMP) for the Bottomfish and Seamount Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) in 1986. The Western Pacific Regional Fishery Management Council (Council) developed the FMP to manage the bottomfish and seamount resources occurring in its area of jurisdiction as defined in the Magnuson Fishery Management and Conservation Act of 1976.

The Bottomfish FMP required the Council to establish a Bottomfish Plan Monitoring Team (Team) to prepare an annual report on the status of the bottomfish fishery for each of the island areas served by the Council. The Team decided to adopt a modular approach to developing the annual report, whereby each island area would develop an individual report for its bottomfish fishery and would submit the report to the Team for review. This is the third annual report module submitted to the Team on behalf of the Government of Guam to help the Team determine the effectiveness of the FMP in meeting its goal in Guam.

This report was prepared by staff members of NOAA Fisheries Honolulu Laboratory's Western Pacific Fishery Information Network (WPACFIN) and the Guam Division of Aquatic and Wildlife Resources (DAWR). It is based on two major sets of data: commercial landings data collected by WPACFIN through a voluntary reporting system established by WPACFIN in 1982 with major fresh fish dealers on Guam, and creel survey data collected by DAWR. Through cooperative efforts of the agencies involved, this annual report on the bottomfish fishery of Guam is DAWR's official submission to the Team for the 1988 calendar year.

This report provides data for 1988 and updates the time series of published data on the bottomfish fishery of Guam. Although additional data quality control procedures conducted recently resulted in minor data base modifications, this report does not review all previously described and published detailed information on the fishery. However, it does provide tables of updated annual summary data for important parameters. Both data collection systems used to monitor Guam's fisheries have limitations related to the sample sizes included in the data bases; hence, data from both systems are presented to provide a more complete and accurate description of the fishery. For additional background information on Guam's data collection systems, assumptions, and analyses used to summarize data in this report, the bottomfish fishery, or specifics on other Guam fisheries, refer to the Team's other annual reports, volumes of WPACFIN's "Fishery Statistics of the Western Pacific" (Hamm et al. 1986, Hamm and Quach 1988b, 1989), Hamm and Quach (1988a), or DAWR annual reports.

I. FISHERIES PERFORMANCE DATA

Tables 1-9 and Figures 1-15 summarize annual and monthly fishery performance data for 1988 and update the time series available for establishing trends in the fishery.

1. Total Landings by Species, by Area, and by Month

The bottomfish fishery remains a fairly small fraction (5%) of the total commercial fisheries of Guam (Figures 1-2). Recorded 1988 commercial bottomfish landings (7,896 pounds) continued to decline for the third year in a row to the lowest recorded landings since 1982, whereas, DAWR-estimated total bottomfish landings (53,729 pounds) continued to increase for the third consecutive year (Figure 4). The relative importance of productivity of the offshore banks northeast of Guam (Figure 3) continued to increase, as did the nearshore tips of the island, while the banks southwest of Guam decreased in relative importance (Figure 5). The general trend of increasing importance of offshore banks in the bottomfish fishery continued in 1988 (Figure 6). Further testing will be required to establish whether this can be attributed to a fall in catch per unit effort (CPUE) nearshore, an increase in boat size, or some combination of both.

2. Estimated Ex-Vessel Revenue by Species

Tables 3 and 4 provide the 1988 annual and monthly ex-vessel values by species and the average price paid for each species. Figure 4 shows the historical fluctuations in the value of the fishery, that the 1988 value of the landings ($14,784) was the lowest recorded since 1982, and that the average price per pound has remained fairly stable.

3. Fishing Effort

A. Number of Vessels and Trips

The number of vessels making commercial bottomfish trips and landings continued to decline during 1988, to the lowest number since 1982 (Figure 7). The CPUE of these boats is measured by trip or by hour. Even though the number of boats declined, the overall average catch per trip for all vessels landing bottomfish commercially remained the same for the third consecutive year. For those trips in which effort (hours) was recorded, the average catch per trip and catch per hour increased slightly in 1988 (Figure 8).

The DAWR creel survey data show fluctuating but similarly stable CPUE (Figure 9), but a contrasting increase in catch and effort for the past 2 years (Figure 10). The creel survey catch per trip is about half that recorded for commercial trips. The absence of obvious trends in CPUE seems to indicate a relatively stable fishery resource.

Table 2 demonstrates two ways to calculate catch per hour

and its associated standard deviation (SD) and coefficient of variation (CV). The differences in the two methods of calculation are based on differences in the definition of CPUE. The estimated annual average CPUE (CPUE1) is calculated by adding all of the catch for the year and dividing by the sum of the hours required to land that catch, and has no associated variance. (Actually, there may be one or more somewhat more complicated ways to estimate this variance given certain assumptions, but these methods were not investigated). This method of calculating CPUE essentially weights the estimate by size of landing. The other average CPUE (CPUE2) treats each trip as an observation and weights each resultant individual trip catch rate equally. Its associated variance, and hence SD and CV, can also be calculated two ways, depending on one's definition of trip CPUE, e.g., based on whether it is considered a single observation or an average of hourly observations. As can be seen in Table 2 and Figure 8, the resultant CPUE's and CV's can differ radically depending on which definition is used, e.g., in 1984 CPUE's were 2.5 vs. 6.4 pounds per hour, with CV's of 512 vs. 31 percent. Similar comparisons are shown for the creel survey data in Table 7 and Figure 9. In the calculation of CPUE2 for the creel survey data, a daily average catch per hour, rather than individual trip, is used as the observation. Standardization of definition is obviously needed. However, regardless of which method is used, in the absence of more precise statistical analysis of changes in CPUE's, it does not appear that the decline in the Guam bottomfish fishery is due to declining catch rates.

A cursory examination of landings from Baby Banks, formerly one of the most productive banks southwest of Guam, shows that the fishing pressure decreased and the catch rate increased in 1988 (Table 6). It also shows that none of the three main fishermen who previously fished this bank fished it during 1988. Once again, the declining catch appears to be for reasons other than declining catch rates.

B. Species Composition and Other Indicators of Fishery Performance

Figure 11 shows the seasonal distribution of the bottomfish landings. Most landings are made during the calmer summer months, May through August, when the major pelagic fisheries for mahimahi and wahoo are least active. However, even during the peak bottomfish fishing season, landings of pelagic species far outweigh bottomfish, and virtually all commercial bottomfish fishing trips are also trolling trips. Guam does not have an exclusive bottomfish fishery.

Changes in species composition typically indicate changes in a fishery, either in the stocks or the fishing activity itself. The percent composition of commercial bottomfish catch for eight important deepwater bottomfish species are plotted in Figures 12 and 13. Onaga and grouper showed fairly substantial increases, whereas uku showed a tremendous decline. The other species remained relatively unchanged, with slight increases for all but

ehu, which decreased slightly. The creel survey percent species composition for these eight species (Figures 14 and 15) showed similar trends as the commercial landings for all but uku, which increased substantially rather than declined. Based on a cursory examination of these data, there does not seem to be any significant changes in species composition. A statistically valid examination of the data is needed.

4. Biological Characteristics of the Landings

A. Size-Frequency Analysis

Specific objectives and guidelines for this area have not been determined by the Team. Currently available bottomfish size-frequency data are sparse and not in a single, easily analyzed form. No analyses were performed.

B. Maximum Sustainable Yield

The 1988 commercial landings of 7,896 pounds were only 14% of the estimated maximum sustainable yield (MSY) of 56,800 pounds for Guam bottomfish. However, the DAWR creel survey estimated that the total catch of bottomfish for 1988 (53,729 pounds) was 95% of the estimated MSY. Since the current MSY estimates exclude the Lethrinids, the most important group in Guam's bottomfish management unit species (BMUS), these figures may be misleading. Additionally, recent research indicates that use of MSY theories may not be realisitc for management purposes.

5. Summary Table of Fishery Status

Status of the Guam Bottomfish Fishery

	Problem Condition	Present in the Bottomfish Fishery	Comment
1.	Mean catch size is prereproductive	Data not available	
2.	Unacceptable ratio of fish mortality to natural mortality	Data not available	Mortality may be a useful management tool, but it may not be possible to determine
3.	Catch exceeds MSY	No	MSY needs to be reestimated

	Problem Condition	Present in the Bottomfish Fishery	Comment
4.	Significant decline in CPUE	Not indicated	Need to standardize which CPUE and CV to use, and establish limits of significance
5.	Substantial decline in ex-vessel revenue relative to baseline levels	Possibly	Price is stable but fishery has declined in landings and revenue
6.	Significant shift in gear, by area	Possible shift in area, same gear	Shift isn't CPUE related
7.	Significant change in the frozen/fresh components of catch	No, it is still a fresh fish fishery	
8.	Unstable pattern of entry/exit to the fishery	Yes	Need to define unstable statistically
9.	Per trip costs exceed per trip revenue	Data not available	Survey results available later
10.	Significant decline or increase in total bottomfish landings	Possibly	Need more analysis and definition of significant
11.	Change in species composition of catch	Not indicated	Need to define change statistically
12.	Research results indicate problems	No research done	
13.	Habitat degradation or environmental problems	Data not available	
14.	Increased interaction with protected species	No	

II. RECENT RESEARCH AND SURVEY RESULTS

Results of DAWR's offshore creel surveys are presented, in part, in the previous section. For additional information on these surveys see the references. The DAWR is making more in-depth analyses of its existing creel survey data, but results are not yet available.

III. HABITAT CONDITIONS AND RECENT ALTERATIONS

No information regarding this topic is available at present.

IV. ENFORCEMENT ACTIVITIES AND PROBLEMS

Information on enforcement activities should be obtained from the NMFS Enforcement Southwest.

V. ADMINISTRATIVE ACTIONS AND RECOMMENDATIONS

Arrangements should be made to transfer the technical capability and physical responsibility of producing Guam's annual Team module to the newly appointed Bottomfish Team member from Guam.

It is recommended that the existing DAWR creel survey system be modified or a special program established to collect enough size-frequency data to properly monitor the fishery.

The existing commercial landings system should be expanded to include some of the smaller direct purchasers of fish (stores, hotels, restaurants); the system should be improved to collect better location and effort data and better species breakdown of the bottomfish catch. Neither the WPACFIN program nor DAWR has funds to accomplish this task. Additionally, current funding at DAWR allows no personnel time for working on commercial fisheries. This must be changed if DAWR is to fully take over the Team responsibilities for Guam.

Further analyses and studies should be conducted to better describe the fishery, explain, and interpret the fluctuations, and make recommendations for stabilization of the fishery. Studies of stock assessment also are needed. The Team needs to hold a workshop to establish structured objectives and guidelines describing the recommended data collection, statistical analyses, and reporting necessary to meet the needs of the Team and the Council.

VI. TERRITORY MANAGEMENT ACTIONS

No territorial management actions have taken place regarding the bottomfish fishery. Based on the information presented in this report, no fishery management territorial actions are needed

at this time. However, improvement of the commercial landings data collection system would best be handled through action on the part of Guam's fisheries agencies, e.g., the Department of Commerce and DAWR.

VII. ASSESSMENT OF NEED FOR COUNCIL ACTION

Although the presentation of available data does not identify any problems in the bottomfish fishery of Guam, except for a continuing decline of unknown cause in the commercial fishery, there remain several significant deficiencies in the data base. Additional data are needed, data systems need to be improved, analyses need to be expanded and strengthened, and local expertise needs to be utilized.

Existing computer programs for summarizing and analyzing available data are insufficient to properly monitor the resource and describe the fishery. Assistance is needed to develop these tools to be used by DAWR biologists in preparation of subsequent annual reports. The development of relevant island modules is currently limited by the vague guidelines established in the FMP. The data available since the formulation of the FMP have changed, and amendment of the FMP to reflect a new structure would be helpful. If island modules are expected to provide data, analyses, and recommendations, the procedures, types of data required, statistical approaches, and overall objectives must be specifically identified by the Team.

VIII. RECOMMENDATIONS FOR COUNCIL ACTION

To date, only visual interpretations have been used on the data. More thorough and statistically valid analyses should be performed on the data to determine whether trends or problems actually exist in this fishery. The Team should identify specific questions about the fishery; form hypotheses to answer these questions; determine analytical methods to test these hypotheses; provide guidelines for interpreting the analyses; and determine what constitutes trends, changes, or problems in the fishery. The Team should develop specific recommendations for format and content of the annual report modules. A special 2- to 5-day workshop should be held, possibly in concert with the Bottomfish Team and select members of the Council's Scientific and Statistical Committee, to resolve these problems for all Council management areas.

The commercial landings system should be improved to include a broader coverage. Currently the WPACFIN staff coordinate, collect, and process the commercial landings and effort data for Guam. The DAWR has a concern and interest in collecting this information but is limited to involvement in recreational and subsistence fisheries only, because 100% of its funding is through Dingell-Johnson funds, which cannot be used for commercial activities. If the Guam report module is to include commercial data, a mechanism, e.g., funding, must be developed to

support DAWR's involvement in the commercial fisheries.

It is recommended that the Council support development of a special study on size frequency of the most important commercial bottomfish species for Guam. This study should include complete analysis of existing data and a sampling program capable of obtaining enough size information to adequately describe the current stock structure.

IX. ESTIMATED IMPACTS OF RECOMMENDED ACTION

Analysis of existing data and development of a size-frequency sampling project will provide a more complete understanding and monitoring of the Guam bottomfish fishery.

REFERENCES

Guam Department of Agriculture, Division of Aquatic and Wildlife Resources Annual Reports. Fiscal years 1979 through 1988. var. pag.

Hamm, D. C., and M. M. C. Quach.
1988a. Bottomfish fisheries of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-88-15, 76 p.

1988b. Fishery statistics of the western Pacific, volume III. Territory of American Samoa (1985-86), Commonwealth of the Northern Mariana Islands (1985-86), Territory of Guam (1985-86), State of Hawaii (1985-86). Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-88-4, var. pag.

1989. Fishery statistics of the western Pacific, volume IV. Territory of American Samoa (1987), Commonwealth of the Northern Mariana Islands (1987), Territory of Guam (1987) State of Hawaii (1987). Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-89-1, var. pag.

Hamm, D. C., M. M. C. Quach, and Todd T. Kassman.
1986. Fishery statistics of the western Pacific, volume II. Territory of Guam (1979-84). Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-86-20, var. pag.

Western Pacific Regional Fishery Management Council (Council).
1988. 1987 Western Pacific Regional Fishery Management Council annual report for the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Western Pacific Regional Fishery Management Council, 1164 Bishop Street, Honolulu, HI 96813, var. pag.

1988. 1986 Western Pacific Regional Fishery Management Council annual report for the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Western Pacific Regional Fishery Management Council, 1164 Bishop Street, Honolulu, HI 96813, var. pag.

APPENDIX A: TABLES

Table 1

Summary of the Guam Commercial Bottomfish Fishery 1980-88

		1980	1981	1982	1983	1984	1985	1986	1987	1988
Total commercial landings in pounds		105014	145970	140762	311029	281402	296624	237512	219507	159716
Total landings of bottomfish species	pounds	7036	8367	5625	33020	19182	25494	10869	10111	7896
	dollars	8594	14872	10840	59825	37051	47604	19618	18841	14784
	avg $/lb	1.22	1.78	1.93	1.81	1.93	1.87	1.80	1.86	1.87
Percent of bottomfish landings to total landings		6.7	5.7	4.0	10.6	6.8	8.6	4.6	4.6	4.9
Number of trips which landed bottomfish		111	187	152	409	396	431	229	213	169
Number of fishermen (boats) landing bottomfish*		30	38	34	50	63	59	43	38	35
Bottomfish catch per trip		63	45	37	81	48	59	47	47	47
Total catch of bottomfish by highliners**		4398	2090	1634	26037	11275	14540	5395	4240	2016
Percent of total bottomfish landed by highliners		63	25	29	79	59	57	50	42	26
Number of trips made by highliners		9	40	29	110	142	128	27	56	18
Number of highliners		1	1	1	6	5	6	2	3	1
Catch per trip of highliners		489	52	56	237	79	114	200	76	112

* Number of known fishermen plus one to account for landings by miscellaneous fishermen.

** Highliners = fishermen (boats) landing over 1,000 pounds of bottomfish during the year.

Table 2

Summary of the Guam Commercial
Bottomfish Fishery
for Boats With Known Effort 1980-88

	1982	1983	1984	1985	1986	1987	1988
Number of fishermen	12	38	55	51	42	36	34
Percent of total bottom fishermen	35	76	78	85	100	95	97
Number of trips	33	210	273	357	216	179	162
Percent of total bottomfish trips	22	51	69	83	94	84	96
Total hours	377	3443	4653	4821	2240	1796	1303
Total landings	1184	17058	11669	22226	9196	8160	7714
Hours per trip	11	16	17	14	10	10	8
CV	96	118	102	121	82	76	58
Catch per trip	36	81	43	62	43	46	48
CV	103	307	120	162	143	103	116
Catch per hour (CPUE1) (sum catch/sum hrs) (Annual est. observation)	3.1	5.0	2.5	4.6	4.1	4.5	5.9
Catch per hour (CPUE2) (sum(catch/hrs)/sum trips) (trip is an observation)	4.0	4.1	6.4	5.9	7.3	4.9	7.1
Standard Deviation and Coefficient of Variation of CPUE2							
With trip CPUE defined as a sample observation							
SD=std(lbs/hrs) (SD1)	2.4	6.5	32.5	7.8	39.4	4.3	8.7
CV=(SD1/CPUE2) (CV1)	60	158	512	132	540	88	124
With trip CPUE defined as a "mean" observation							
SD=(SD1/sqrt(trips)) (SD2)	0.4	0.5	2.0	0.4	2.7	0.3	0.7
CV=(SD2/CPUE2) (CV2)	11	11	31	7	37	7	10

Table 3

Guam 1988 Commercial Landings
Of Bottomfish Species

Species	Records	Pounds	Value	$/lb
Jacks	48	1,215.45	1,649.40	1.36
Bottomfish	104	3,198.25	6,377.22	1.99
Ehu (red snapper)	7	82.50	185.62	2.25
Gindai (flower snap)	31	580.00	1,304.95	2.25
Grouper	5	773.50	726.00	0.94
Kalikali (pink snap)	7	60.50	122.12	2.02
Lehi (silverjaw)	3	97.00	218.25	2.25
Onaga (red snapper)	19	910.50	2,272.87	2.50
Opakapaka (pink snp)	17	462.50	1,040.63	2.25
Uku (gray snapper)	21	286.50	428.50	1.50
Emperor (mafute)	9	229.25	458.50	2.00
** Total Bottomfish**	271	7,895.95	14,784.06	1.87
** TOTAL ALL SPECIES**	3,722	159,715.61	227,828.37	1.43

Table 4

Guam 1988 Monthly Commercial Landings
Of Bottomfish Species

Species	Records	Pounds	Value	$/lb
** January **				
Jacks	2	118.00	131.75	1.12
Bottomfish	3	42.00	84.00	2.00
** Total Bottomfish**	5	160.00	215.75	1.35
** TOTAL ALL SPECIES**	273	9,719.75	17,418.79	1.79
** February **				
Jacks	1	35.00	43.75	1.25
Bottomfish	1	6.00	12.00	2.00
** Total Bottomfish**	2	41.00	55.75	1.36
** TOTAL ALL SPECIES**	341	14,086.50	21,171.53	1.50
** March **				
Bottomfish	3	127.00	245.75	1.94
** Total Bottomfish**	3	127.00	245.75	1.94
** TOTAL ALL SPECIES**	399	24,229.62	34,376.69	1.42

Table 4 (Cont.)

Species	Records	Pounds	Value	$/lb
** April **				
Jacks	3	60.00	80.37	1.34
Bottomfish	11	457.00	1,001.85	2.19
Gindai (flower snap)	1	19.50	43.87	2.25
Uku (gray snapper)	5	85.50	128.25	1.50
** Total Bottomfish**	20	622.00	1,254.34	2.02
** TOTAL ALL SPECIES**	428	17,928.00	24,694.54	1.38
** May **				
Jacks	6	73.00	109.50	1.50
Bottomfish	8	139.00	251.00	1.81
Gindai (flower snap)	3	102.50	230.62	2.25
Onaga (red snapper)	3	135.00	334.12	2.47
Opakapaka (pink snp)	2	6.50	14.62	2.25
Uku (gray snapper)	2	12.00	18.00	1.50
Emperor (mafute)	5	164.75	329.50	2.00
** Total Bottomfish**	29	632.75	1,287.36	2.03
** TOTAL ALL SPECIES**	404	14,212.45	20,426.41	1.44
** June **				
Jacks	11	168.45	222.67	1.32
Bottomfish	18	426.00	825.00	1.94
Ehu (red snapper)	1	4.00	9.00	2.25
Gindai (flower snap)	6	171.50	385.87	2.25
Grouper	1	208.00	156.00	0.75
Kalikali (pink snap)	2	13.00	26.00	2.00
Lehi (silverjaw)	1	18.00	40.50	2.25
Onaga (red snapper)	3	175.50	438.75	2.50
Opakapaka (pink snp)	6	113.00	254.26	2.25
Uku (gray snapper)	4	54.50	81.75	1.50
** Total Bottomfish**	53	1,351.95	2,439.80	1.80
** TOTAL ALL SPECIES**	305	13,237.45	17,855.66	1.35

Table 4 (Cont.)

Species	Records	Pounds	Value	$/lb
** July **				
Jacks	6	255.00	352.25	1.38
Bottomfish	16	740.00	1,459.50	1.97
Ehu (red snapper)	1	8.00	18.00	2.25
Gindai (flower snap)	5	65.00	146.25	2.25
Grouper	1	4.50	9.00	2.00
Kalikali (pink snap)	2	25.00	50.00	2.00
Onaga (red snapper)	3	93.50	233.75	2.50
Opakapaka (pink snp)	4	187.00	420.75	2.25
Uku (gray snapper)	7	114.00	169.75	1.49
Emperor (mafute)	1	5.00	10.00	2.00
** Total Bottomfish**	46	1,497.00	2,869.25	1.92
** TOTAL ALL SPECIES**	348	14,348.15	18,073.37	1.26
** August **				
Jacks	5	118.50	159.25	1.34
Bottomfish	11	293.50	570.12	1.94
Ehu (red snapper)	2	44.00	99.00	2.25
Gindai (flower snap)	4	82.00	184.49	2.25
Grouper	1	303.50	303.50	1.00
Kalikali (pink snap)	2	18.00	36.00	2.00
Lehi (silverjaw)	1	17.00	38.25	2.25
Onaga (red snapper)	2	216.00	540.00	2.50
Opakapaka (pink snp)	1	47.50	106.87	2.25
Uku (gray snapper)	1	4.50	6.75	1.50
** Total Bottomfish**	30	1,144.50	2,044.23	1.79
** TOTAL ALL SPECIES**	297	14,379.75	16,755.73	1.66
** September **				
Jacks	9	208.50	286.49	1.37
Bottomfish	15	432.25	864.50	2.00
Ehu (red snapper)	1	9.00	20.25	2.25
Gindai (flower snap)	8	97.00	218.24	2.25
Lehi (silverjaw)	1	62.00	139.50	2.25
Onaga (red snapper)	5	134.50	336.25	2.50
Opakapaka (pink snp)	3	72.00	162.00	2.25
Uku (gray snapper)	1	4.00	6.00	1.50
** Total Bottomfish**	43	1,019.25	2,033.23	1.99
** TOTAL ALL SPECIES**	218	10,087.75	14,693.86	1.46

Table 4 (Cont.)

Species	Records	Pounds	Value	$/lb
** October **				
Jacks	2	137.00	205.50	1.50
Bottomfish	14	438.50	869.50	1.98
Ehu (red snapper)	1	15.00	33.75	2.25
Gindai (flower snap)	4	42.50	95.61	2.25
Grouper	2	257.50	257.50	1.00
Kalikali (pink snap)	1	4.50	10.12	2.25
Onaga (red snapper)	2	130.50	326.25	2.50
Opakapaka (pink snp)	1	36.50	82.13	2.25
Uku (gray snapper)	1	12.00	18.00	1.50
** Total Bottomfish**	28	1,074.00	1,898.36	1.77
** TOTAL ALL SPECIES**	308	12,625.94	19,849.57	1.57
** November **				
Bottomfish	2	53.00	106.00	2.00
** Total Bottomfish**	2	53.00	106.00	2.00
** TOTAL ALL SPECIES**	217	8,752.25	12,910.48	1.48
** December **				
Jacks	3	42.00	57.87	1.38
Bottomfish	2	44.00	88.00	2.00
Ehu (red snapper)	1	2.50	5.62	2.25
Onaga (red snapper)	1	25.50	63.75	2.50
Emperor (mafute)	3	59.50	119.00	2.00
** Total Bottomfish**	10	173.50	334.24	1.93
** TOTAL ALL SPECIES**	184	6,108.00	9,601.74	1.57

Table 5

Percent Of Total Known Bottomfish Landings
By Area Fished

Area	84	85	86	87	88
Northern Mariana Islands	38	10	10	0	0
Northeast Banks	7	16	9	16	39
Southwest Banks	9	17	36	48	31
Nearshore Island Tips	4	17	14	16	18
Other Nearshore Reefs	42	40	31	20	12
EEZ - >3 miles from shore	54	43	55	64	70
Guam - <3 miles from shore	46	57	45	36	30

Table 6

Baby Bank Summary Information

	1985	1986	1987	1988
Number Of Boats	12	13	16	9
Number Of Trips	24	27	30	15
Bottomfish Landings	1325	1613	1814	932
Hours Fished	305	432	355	125
Catch Per Trip	55	60	60	62
Catch Per Hour	4.3	3.7	5.1	7.5
Catch Per Hour Fisher 1	8.6	2.0	4.0	-
Catch Per Hour Fisher 2	7.9	1.7	5.3	-
Catch Per Hour Fisher 3	5.7	5.3	-	-

Table 7

Guam DAWR Creel Survey Summary Statistics

Year	Catch	CV	Boat hrs.	CV	Trips	CV	*CPUE1	**CPUE2	CV
1979	28243	22	8416	20	1918	17	3.4	4.3	13
1980	37149	38	4734	29	919	24	7.8	6.6	53
1981	61639	27	8523	17	2082	14	7.2	6.9	36
1982	60417	21	8215	11	2129	9	7.4	7.2	20
1983	53002	25	8620	16	2378	12	6.1	5.2	13
1984	52355	14	7141	12	2019	11	7.3	6.9	10
1985	92916	13	16242	11	3419	8	5.7	5.5	10
1986	29892	34	4945	18	1229	15	6.0	5.1	22
1987	34601	22	6191	20	1428	16	5.6	5.5	13
1988	53729	19	10044	14	2606	12	5.3	4.8	8

* CPUE1 - annual catch divided by annual boat hours
** CPUE2 - average of daily CPUE

Table 8

GUAM CREEL SURVEY SPECIES COMPOSITION OF SELECTED BOTTOMFISH
(UNALLOCATED MISCELLANEOUS BOTTOMFISH)

SPECIES %	1980	1981	1982	1983	1984	1985	1986	1987	1988
Grouper	627	6442	9441	3971	1519	7736	1226	4087	7403
	2.40%	11.79%	17.95%	8.75%	3.02%	9.25%	4.67%	13.09%	15.31%
Jacks	2591	3887	2255	2918	1747	5028	5852	2501	8476
	9.90%	7.11%	4.29%	6.43%	3.47%	6.01%	22.28%	8.01%	17.53%
Snapper	615	2028	3716	2125	765	2976	1911	1097	2993
	2.35%	3.71%	7.06%	4.68%	1.52%	3.56%	7.27%	3.51%	6.19%
Lehi	347	2444	2708	2726	322	1161	609	514	1753
	1.33%	4.47%	5.15%	6.01%	0.64%	1.39%	2.32%	1.65%	3.63%
Uku	1363	1557	4964	1330	841	3149	1348	1052	4079
	5.21%	2.85%	9.44%	2.93%	1.67%	3.77%	5.13%	3.37%	8.44%
Ehu	828	4845	1283	1147	32	1506	694	434	2138
	3.16%	8.86%	2.44%	2.53%	0.06%	1.80%	2.64%	1.39%	4.42%
Onaga	0	4095	1087	3809	220	2904	310	466	1164
	0.00%	7.49%	2.07%	8.39%	0.44%	3.47%	1.18%	1.49%	2.41%
Taape	80	486	479	172	60	1022	199	1438	1181
	0.31%	0.89%	0.91%	0.38%	0.12%	1.22%	0.76%	4.61%	2.44%
Y.T. Kalekale	793	2768	1602	5783	1110	3211	1179	555	1463
	3.03%	5.06%	3.05%	12.74%	2.21%	3.84%	4.49%	1.78%	3.03%
Opakapaka	1491	698	744	1221	117	1219	704	340	268
	5.70%	1.28%	1.41%	2.69%	0.23%	1.46%	2.68%	1.09%	0.55%
Y.E. Opaka	389	2353	1723	4342	484	1677	1394	435	741
	1.49%	4.31%	3.28%	9.57%	0.96%	2.01%	5.31%	1.39%	1.53%
Kalekale	0	17	307	764	0	183	23	0	68
	0.00%	0.03%	0.58%	1.68%	0.00%	0.22%	0.09%	0.00%	0.14%
Gindai	197	1558	1896	1632	291	2521	842	650	1692
	0.75%	2.85%	3.60%	3.60%	0.58%	3.02%	3.21%	2.08%	3.50%
Emperor	10184	11321	17146	11281	10124	28305	4273	11966	12255
	38.91%	20.71%	32.59%	24.86%	20.13%	33.85%	16.27%	38.33%	25.35%
Shallow Bottomfish	0	0	0	0	0	6159	1114	899	1382
	0.00%	0.00%	0.00%	0.00%	0.00%	7.37%	4.24%	2.88%	2.86%
Mixed Bottomfish	6668	10155	3254	2154	32651	13168	3323	3166	547
	25.48%	18.58%	6.19%	4.75%	64.93%	15.75%	12.65%	10.14%	1.13%
Deep Bottomfish	0	0	0	0	0	1687	1268	1615	746
	0.00%	0.00%	0.00%	0.00%	0.00%	2.02%	4.83%	5.17%	1.54%
TOTAL SELECTED SPECIES:	26173	54654	52605	45375	50283	83612	26269	31215	48349
TOTAL ALL BOTTOMFISH SPECIES:	37149	61639	60417	53002	52355	92916	29893	34601	53729

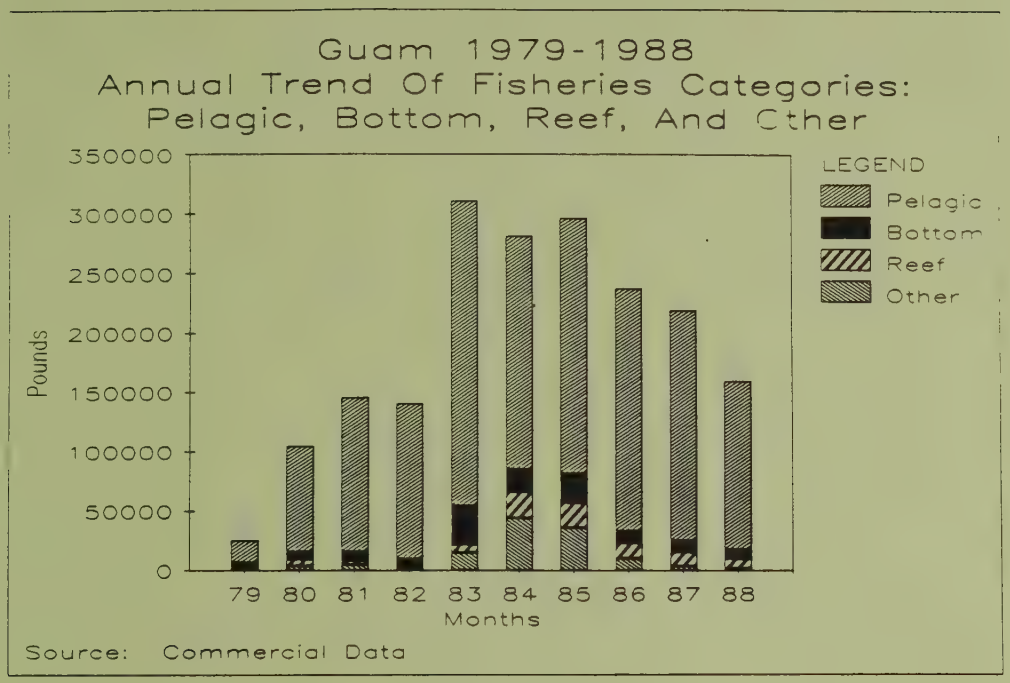
Table 9

GUAM CREEL SURVEY SPECIES COMPOSITION OF SELECTED BOTTOMFISH
(ALLOCATED MISCELLANEOUS BOTTOMFISH)

SPECIES %	1980	1981	1982	1983	1984	1985	1986	1987	1988
Grouper	778	7746	9983	4140	4221	9658	1603	5380	7780
	3.21%	14.48%	19.13%	9.19%	8.62%	11.87%	6.27%	17.56%	16.18%
Jacks	3215	4674	2384	3042	4854	6678	7072	2879	8931
	13.28%	8.74%	4.57%	6.75%	9.91%	8.21%	27.69%	9.40%	18.58%
Snapper	763	2438	3929	2216	2126	3953	2309	1263	3154
	3.15%	4.56%	7.53%	4.92%	4.34%	4.86%	9.04%	4.12%	6.56%
Lehi	431	2939	2863	2842	895	1449	796	677	1842
	1.78%	5.49%	5.49%	6.31%	1.83%	1.78%	3.12%	2.21%	3.83%
Uku	1691	1872	5249	1387	2337	4182	1629	1211	4298
	6.99%	3.50%	10.06%	3.08%	4.77%	5.14%	6.38%	3.95%	8.94%
Ehu	1027	5825	1357	1196	89	1880	907	571	2247
	4.25%	10.89%	2.60%	2.65%	0.18%	2.31%	3.55%	1.86%	4.67%
Onaga	0	4924	1149	3972	611	3625	405	613	1223
	0.00%	9.20%	2.20%	8.81%	1.25%	4.46%	1.59%	2.00%	2.54%
Taape	99	584	506	179	167	1357	240	1656	1244
	0.41%	1.09%	0.97%	0.40%	0.34%	1.67%	0.94%	5.40%	2.59%
Y.T. Kalekale	984	3328	1694	6030	3084	4009	1541	731	1538
	4.07%	6.22%	3.25%	13.38%	6.30%	4.93%	6.03%	2.38%	3.20%
Opakapaka	1850	839	787	1273	325	1522	920	448	282
	7.64%	1.57%	1.51%	2.83%	0.66%	1.87%	3.60%	1.46%	0.59%
Y.E. Opaka	483	2829	1822	4527	1345	2094	1822	573	779
	1.99%	5.29%	3.49%	10.05%	2.75%	2.57%	7.13%	1.87%	1.62%
Kalekale	0	20	325	797	0	228	30	0	71
	0.00%	0.04%	0.62%	1.77%	0.00%	0.28%	0.12%	0.00%	0.15%
Gindai	244	1873	2005	1702	809	3147	1101	856	1778
	1.01%	3.50%	3.84%	3.78%	1.65%	3.87%	4.31%	2.79%	3.70%
Emperor	12637	13612	18130	11762	28130	37593	5164	13777	12912
	52.21%	25.44%	34.74%	26.10%	57.42%	46.20%	20.22%	44.97%	26.86%
TOTAL SELECTED SPECIES:	24203	53503	52184	45065	48991	81376	25541	30634	48079

APPENDIX B: FIGURES

Figure 1



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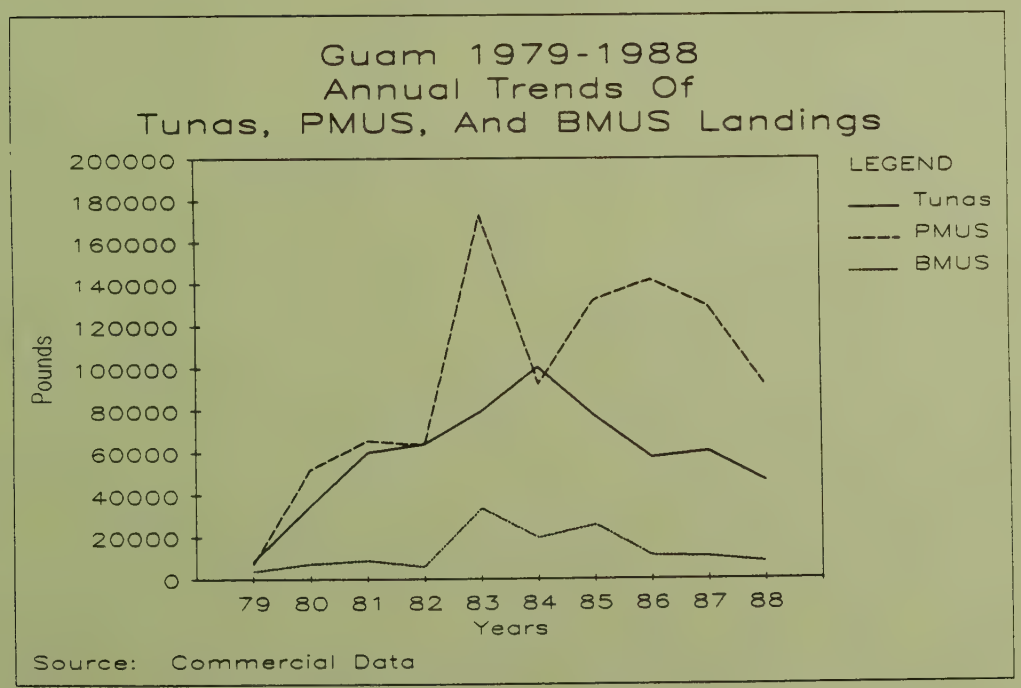

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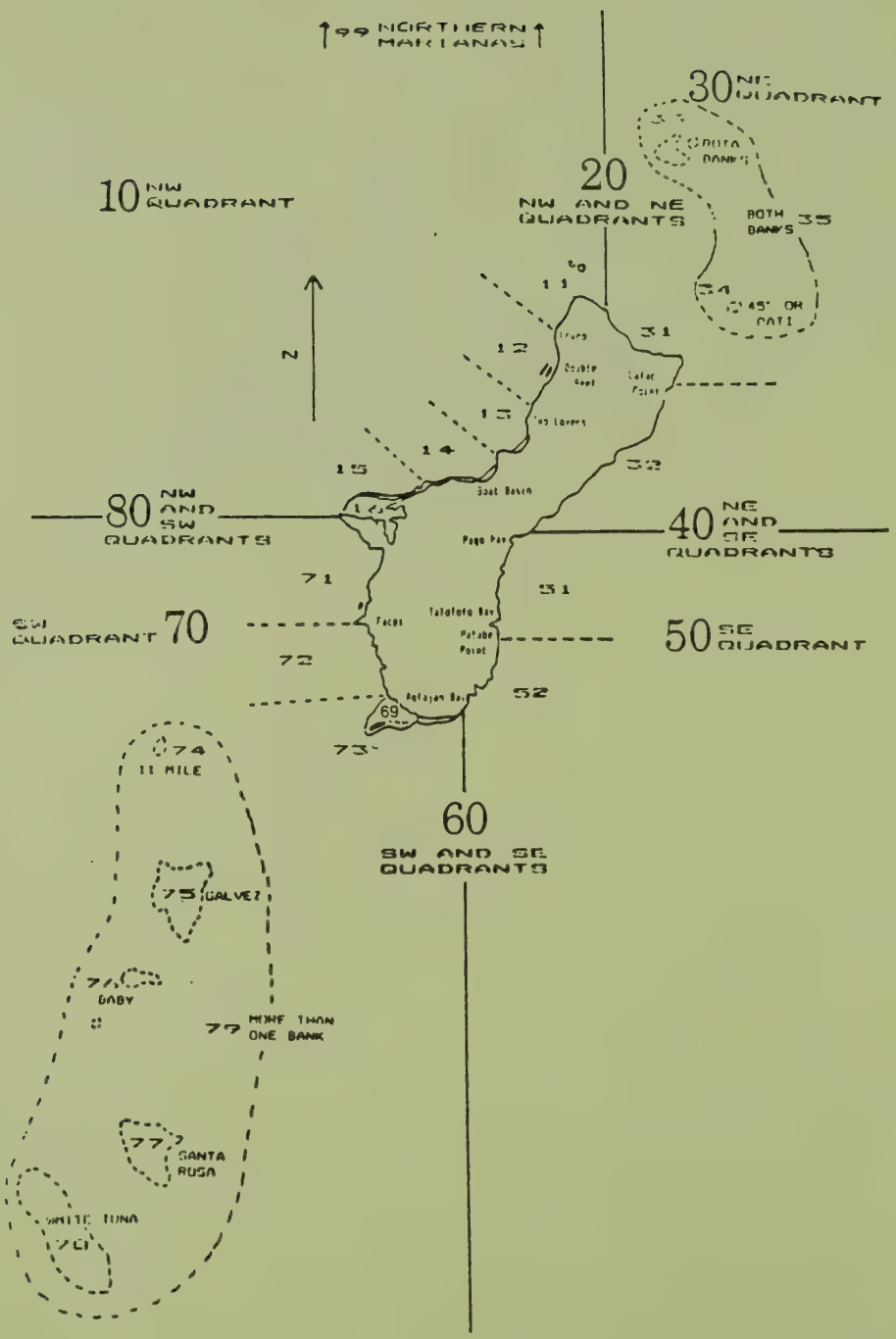
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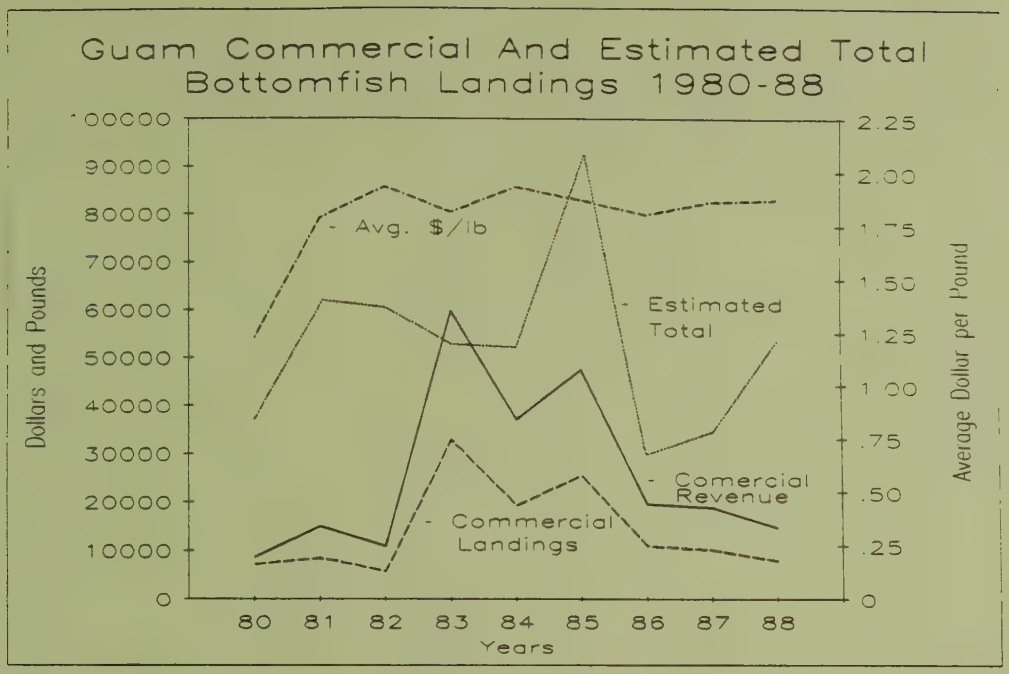
30 NE QUADRANT
10 NW QUADRANT
20 NW AND NE QUADRANTS
BOTH BANKS 35
45° OR CATI
N
80 NW AND SW QUADRANTS
40 NE AND SE QUADRANTS
SW QUADRANT 70
50 SE QUADRANT
60 SW AND SE QUADRANTS
74 11 MILE
75 GALVEZ
76 BABY
77 MORE THAN ONE BANK
77 SANTA ROSA
WHITE TUNA
69

Figure 4



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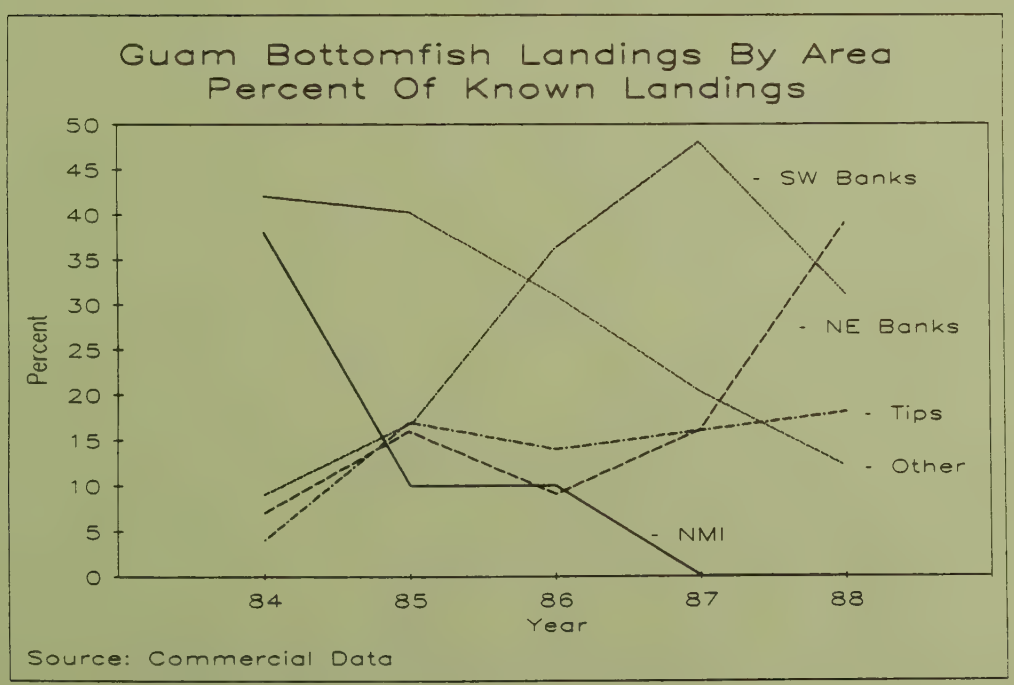

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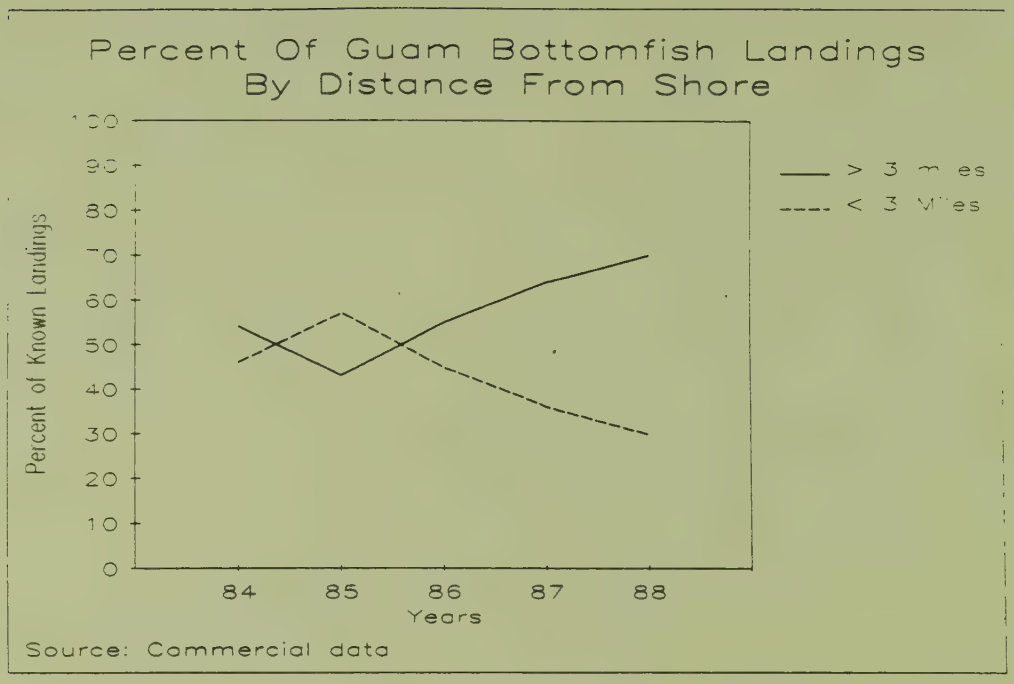

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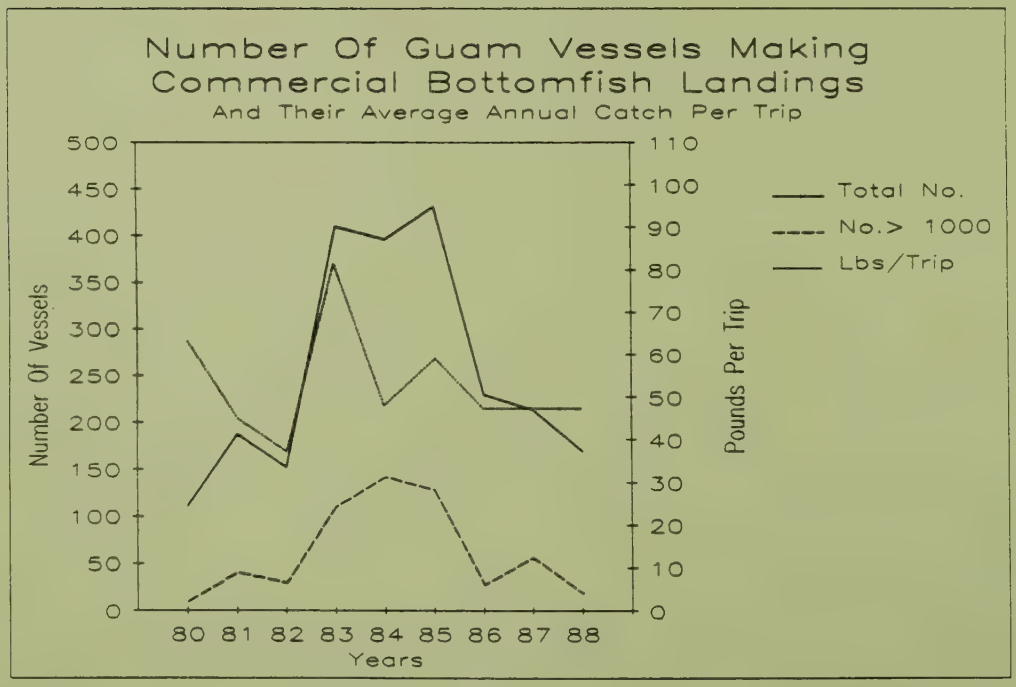

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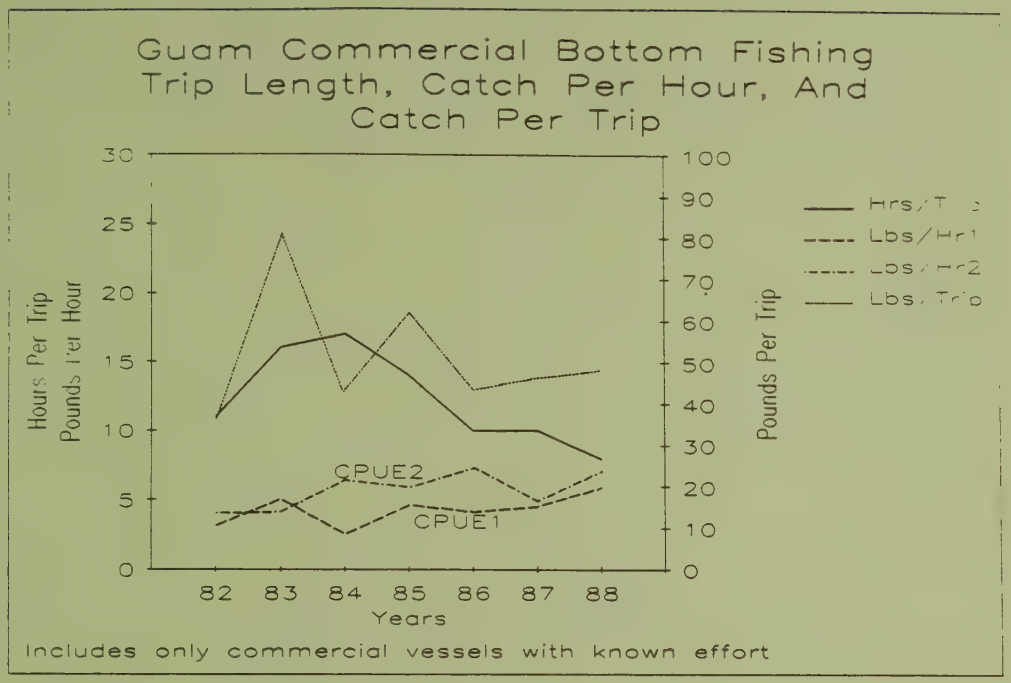

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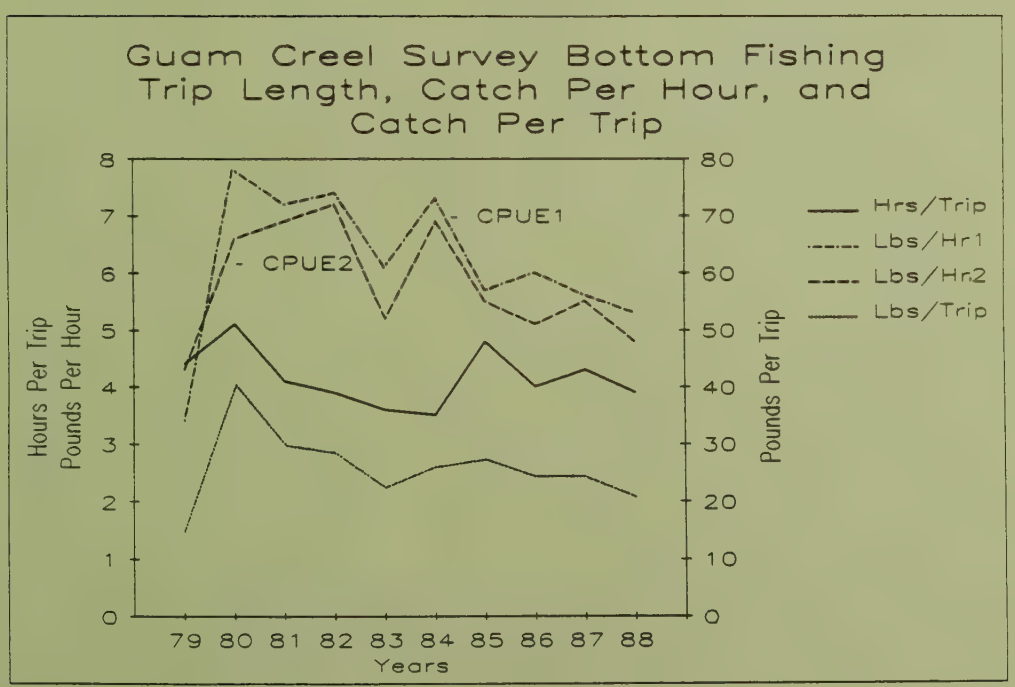
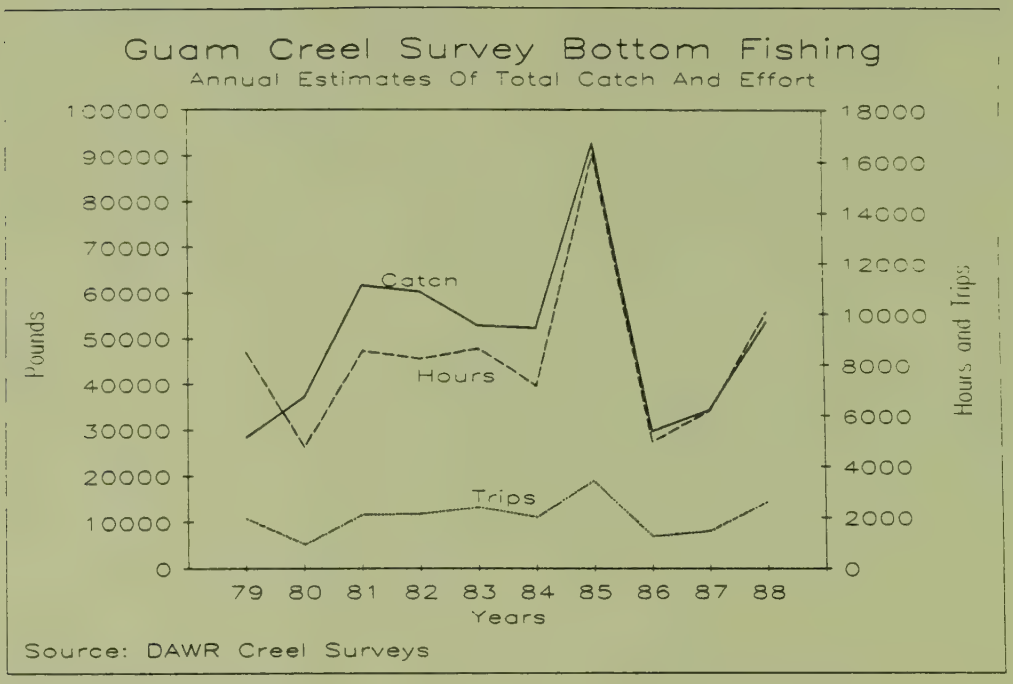


Figure 10



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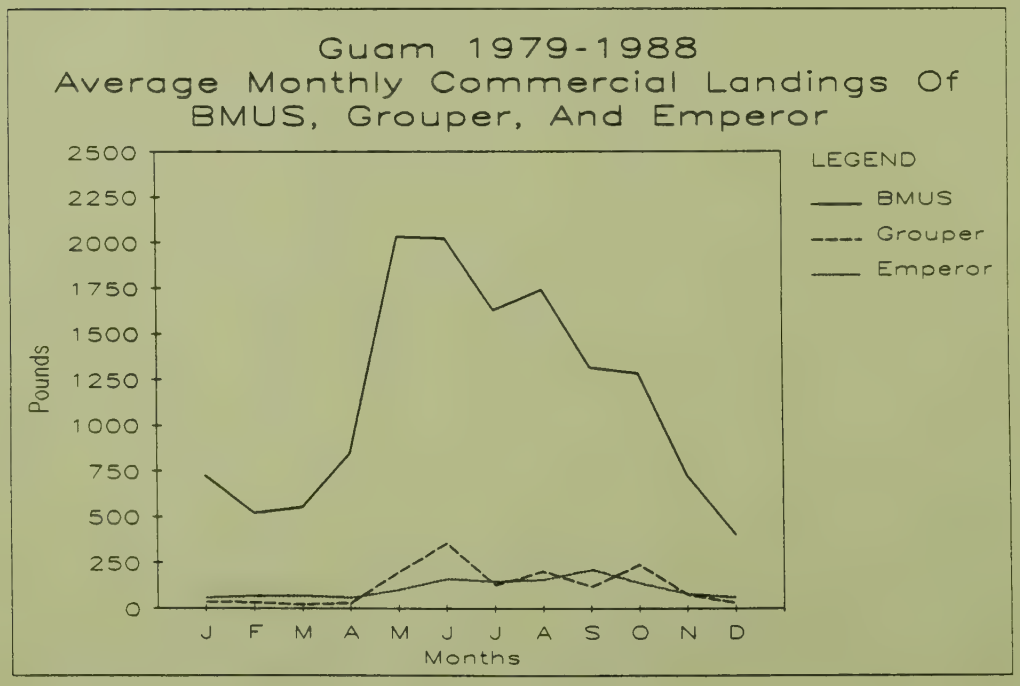

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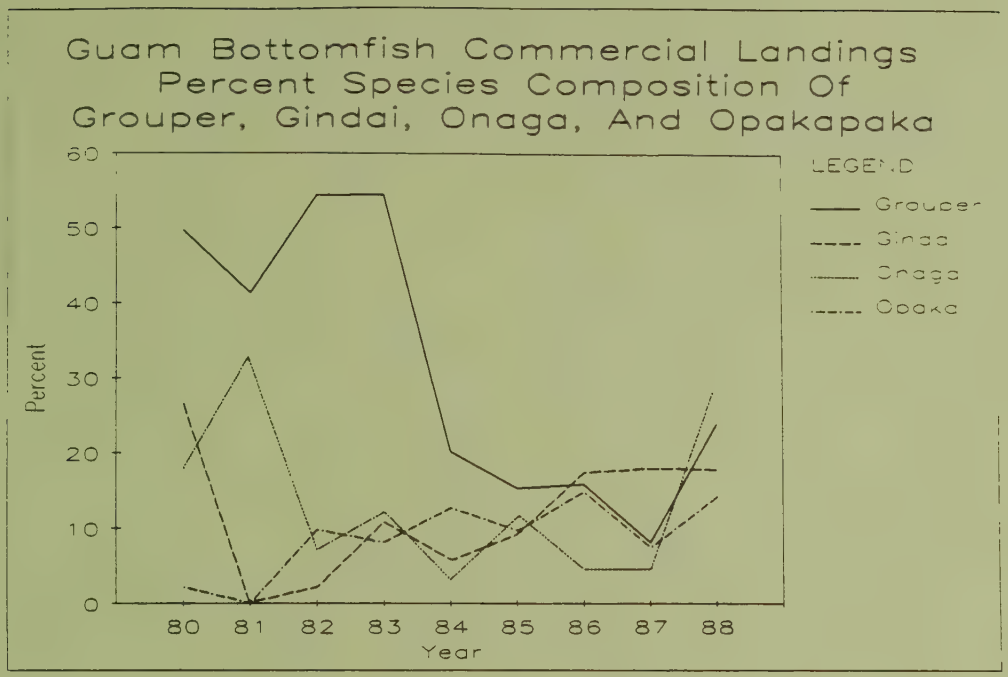

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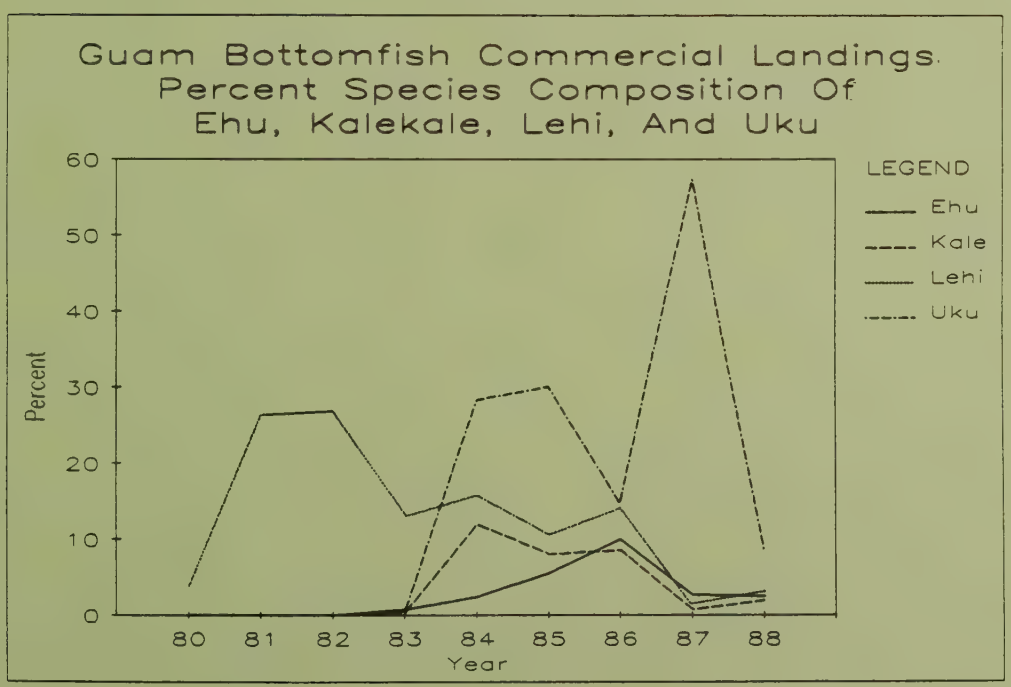

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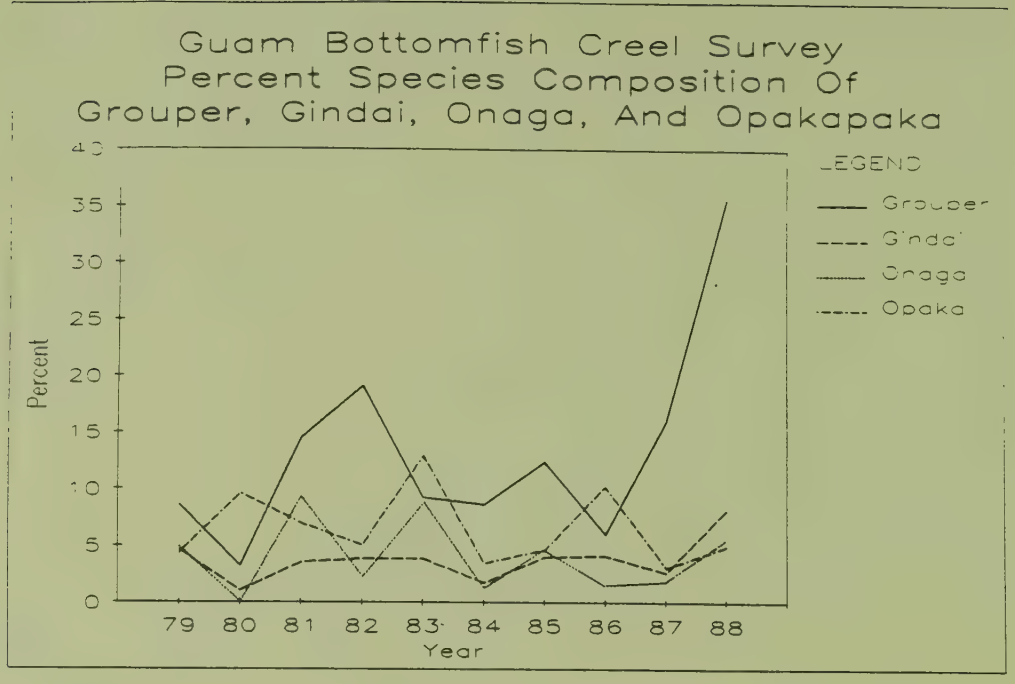
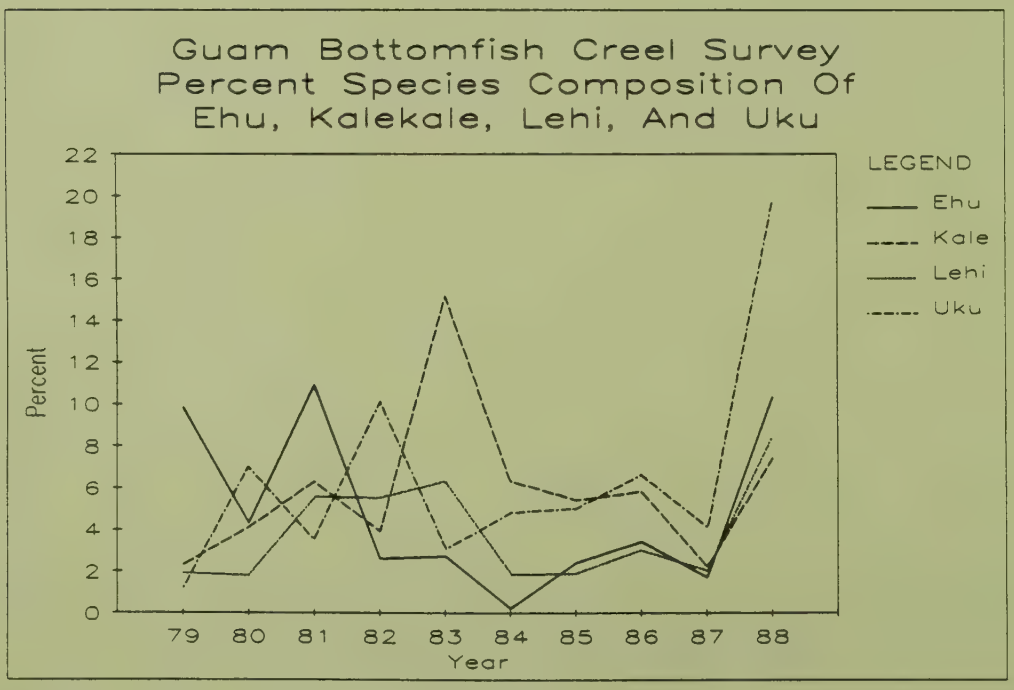


Figure 15



APPENDIX 5

ANNUAL REPORT FOR THE 1988 BOTTOMFISH FISHERY OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

JUNE 1989

PREPARED BY

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FOR THE

Western Pacific Regional Fishery Management Council's

BOTTOMFISH PLAN MONITORING TEAM

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INTRODUCTION

The Fishery Management Plan (FMP) for the Bottomfish and Seamount Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) in 1986. The Western Pacific Regional Fishery Management Council (Council) developed the FMP to manage the bottomfish and seamount resources occurring in its area of jurisdiction as defined in the Magnuson Fishery Management and Conservation Act of 1976.

The Bottomfish FMP required the Council to establish a Bottomfish Plan Monitoring Team (Team) to prepare an annual report on the status of the bottomfish fisheries for each of the island areas served by the Council. The Team decided to adopt a modular approach to developing the annual report, whereby each island area would develop an individual report for its bottomfish fishery and would submit it to the Team for review. This is the third annual report module submitted to the Team on behalf of the Commonwealth of the Northern Mariana Islands' (CNMI) Division of Fish and Wildlife (DFW) to help the Team determine the effectiveness of the FMP in meeting its goal in the CNMI.

Preparation of this report was a cooperative effort among staff of NOAA Fisheries Honolulu Laboratory's Western Pacific Fishery Information Network (WPACFIN) and a newly appointed Team member from the DFW. All data processing was done by WPACFIN in Honolulu but was based on commercial landings data collected by DFW. This report does not include any analyses of DFW's creel survey data. The DFW is upgrading its computer processing capabilities to enable the new Team member to complete all processing for writing future reports, including analysis of creel survey data. The WPACFIN is assisting DFW in meeting this goal. Through cooperative efforts of the agencies involved, this annual report on the bottomfish fisheries of the CNMI is the official submission of the DFW to the Team for the 1988 calendar year.

This report provides data for 1988 and updates the time series of published data on the bottomfish fishery of the CNMI. It does not review all previously described and published information on the fishery. For additional background information on CNMI's data collecting systems, assumptions and analyses used to summarize data in this report, the bottomfish fishery, or specifics on other CNMI fisheries, refer to the Team's other annual reports, volumes of WPACFIN's "Fishery Statistics of the Western Pacific" (Hamm and Kassman 1986; Hamm and Quach 1988b, 1989), or Hamm and Quach (1988a).

I. FISHERIES PERFORMANCE DATA

The CNMI's bottomfish fishery is composed mainly of small boats making trips of up to 24 hours to nearby banks. These trips are often made with mixed gear; boats troll to the banks, commence bottomfishing, and troll during the return leg of the

trip. Fish are taken mostly from banks off Saipan and Tinian, but data are from fish landed on Saipan only.

Tables 1-5 and Figures 1-10 summarize annual and monthly fishery performance data for 1988 and update the time series available for establishing trends in the fishery.

1. Total Landings by Area and Month

Total commercial landings for all CNMI fisheries combined increased in 1988 (Figure 1), but landings of bottomfish declined slightly (Figures 2 and 3). Tunas remained the predominant commercial fishery, while landings of bottomfish management unit species (BMUS) remained slightly higher than landings of the pelagic management unit species (Figure 2).

2. Estimated Ex-Vessel Revenue by Species

The total value of bottomfish landed during 1988 declined proportionally to the decline in the total landings because the average price for the year was essentially the same as in 1987 (Figure 4). Ex-vessel revenue by species is given in Tables 1-2.

3. Fishing Effort Information

A. Number of Vessels and Trips

The total number of fisherman landing bottomfish commercially has declined every year since 1984, down to only 29 in 1988 (Figure 5). The number of fishermen landing over 1,000 pounds of bottomfish per year also declined. The catch of these major fishermen remained essentially the same as 1987 (Figure 6), but they took more trips to catch their fish (Figure 7); thus, their catch per trip during 1988 declined (Figure 8). This is the first year since 1983 that the catch rate of the major fishermen declined.

B. Species Composition and Other Indicators of Fishery Performance

Although the trip ticket receipts used by DFW to collect the commercial data provide several categories for identifying the bottomfish catch, 88% of the bottomfish landings recorded during 1988 were not identified below the general "bottomfish" category. Emperorfish remained the predominant species group of bottomfish during 1988, but onaga showed a tremendous increase (Figure 9). This increase was caused almost entirely by a single fisherman on Tinian; this fisherman has recently begun to target deepwater snappers and is marketing his fish on Saipan.

According to personal communication with the major producer of commercially landed bottomfish on Saipan, the main bottomfish target species, emperorfish, is becoming much harder to catch, and the average size of the fish has decreased. Seasonality of the fishery was typical during 1988 and did not noticeably change the long-term graph (Figure 10). Seasonality in the fishery may

not be a function of the presence or absence of fish on the fishing sites throughout the year, but rather may be the result of seasonal weather patterns that bring rough seas.

4. Biological Characteristics of the Landings

No specific size-frequency data are currently available for bottomfish landed in the CNMI. The trip ticket receipts have been modified to include a field for the number landed, but no data are available for analysis.

The 1988 commercial landings of 37,850 pounds were 21% of the estimated 183,000-pound maximum sustainable yield (MSY) for the CNMI. However, since the vast majority of the catch came from the most southern islands, the percentage of the MSY that was harvested from some locations is undoubtedly much higher.

5. Summary Table of Fishery Status

Status of the CNMI Bottomfish Fishery

Problem Condition	Present in the Bottomfish Fishery	Comment
1. Mean catch size is prereproductive	Data not available	
2. Unacceptable ratio of fish mortality to natural mortality	Data not available	
3. Catch exceeds MSY	No	May have localized problems
4. Significant decline in CPUE	Not indicated	Need further analysis
5. Substantial decline in ex-vessel revenue relative to baseline levels	Maybe	More trips by highliners needed to land same amount as last year
6. Significant shift in gear, by area	Data not available	
7. Significant change in the frozen/fresh components of catch	No, still fresh fish fishery	

Problem Condition	Present in the Bottomfish Fishery	Comment
8. Unstable pattern of entry/exit to the fishery	Yes	Fewest fishers since 1982, steady decline
9. Per trip costs exceed per trip revenue	Data not available	Survey results available later
10. Significant decline or increase in total bottomfish landings	Not indicated	Need more analysis and definition of significant
11. Change in species composition of catch	Possible	More onaga due to new fisher
12. Research results indicate problems	No research done	
13. Habitat degradation or environmental problems	Data not available	
14. Increased interaction with protected species	No	

II. RECENT RESEARCH AND SURVEY RESULTS

The DFW recently began a research program to investigate deepwater bottomfish; however, no data are yet available.

III. HABITAT CONDITIONS AND RECENT ALTERATIONS

No information regarding this topic is available at present.

IV. ENFORCEMENT ACTIVITIES, PLAN ADMINISTRATION, AND PROBLEMS

This section should be added by the NMFS Enforcement branch and the U.S. Coast Guard.

V. ADMINISTRATIVE ACTIONS AND RECOMMENDATIONS

To date, only visual interpretations have been used on the data. The shallow water bottomfish, especially emperorfish, may be under stress. The fishery appears to be declining as a whole. More thorough and statistically valid analyses should be

performed on the data to determine whether trends or problems actually exist in this fishery. The Team should identify specific questions about the fishery; form hypotheses to answer these questions; determine analytical methods to test these hypotheses; provide guidelines for interpreting the analyses; and determine what constitutes trends, changes, or problems in the fishery. The Team should develop specific recommendations for format and content of the annual report modules. A special 2- to 5-day workshop should be held, possibly in concert with the Pelagic Team and select members of the Council's Scientific and Statistical Committee, to resolve these problems for all Council management areas.

The creel survey data that DFW has been collecting since 1986 should be studied to see whether they should be included in the description and analyses of the bottomfish fishery.

The commercial landings system should be improved on Saipan (coverage increased and/or verified) and expanded to Tinian and Rota. Efforts should be made to increase the level of recording actual species identification on the receipts, as well as redesigning the form to include additional species categories.

Length-frequency and biological sampling should be implemented to monitor the major bottomfish species.

VI. TERRITORY MANAGEMENT ACTIONS

No management actions have taken place regarding the bottomfish fishery in the CNMI. Improving the commercial landings system to provide better data on the bottomfish group will be a priority for the DFW.

VII. ASSESSMENT OF NEED FOR COUNCIL ACTION

Although the rudimentary analyses conducted on existing data for this report did not specifically identify any problems in the bottomfish fishery of the CNMI, there remain several significant deficiencies in our information base upon which conclusions can be drawn. Additional data are needed, data systems need to be improved, analyses need to be expanded and strengthened, and local expertise needs to be utilized more fully. Existing computer programs for summarizing and analyzing available data are insufficient to properly monitor the resource and describe the fishery. Assistance is needed to develop these tools to be used by DFW biologists in preparation of subsequent annual reports.

VIII. RECOMMENDATIONS FOR COUNCIL ACTION

It is recommended that the Council support improvement of the CNMI commercial landings system and development of a special study on size frequency of the most important commercial

bottomfish species for the CNMI. This study should include a sampling program capable of obtaining enough size information to adequately describe the current stock structure. The Council should also support the Team and WPACFIN efforts to meet the administrative actions identified above.

IX. ESTIMATED IMPACTS FOR RECOMMENDED ACTIONS

Improvements in the data collecting and processing systems used to monitor and analyze the CNMI's bottomfish fishery would help the Team identify problems in the fishery by providing it with a more complete understanding of the fishery.

REFERENCES

Hamm, D. C. and T. T. Kassman.
1986. Fishery statistics of the western Pacific, volume I. American Samoa (1982-84), Commonwealth of the Northern Mariana Islands (1979-84), State of Hawaii (1987). Southwest Fisheries Center . Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-86-4, var. pag.

Hamm, D. C., and M. M. C. Quach.
1988a. Bottomfish fisheries of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-88-15, 76 p.

1988b. Fishery statistics of the western Pacific, volume III. Territory of American Samoa (1985-86), Commonwealth of the Northern Mariana Islands (1985-86), Territory of Guam (1985-86), State of Hawaii (1985-86). Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-88-4, var. pag.

1989. Fishery statistics of the western Pacific, volume IV. Territory of American Samoa (1987), Commonwealth of the Northern Mariana Islands (1987), Territory of Guam (1987) State of Hawaii (1987). Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-89-1, var. pag.

Western Pacific Regional Fishery Management Council (Council).
1988. 1987 Western Pacific Regional Fishery Management Council annual report for the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Western Pacific Regional Fishery Management Council, 1164 Bishop Street, Honolulu, HI 96813, var. pag.

1988. 1986 Western Pacific Regional Fishery Management Council annual report for the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Western Pacific Regional Fishery Management Council, 1164 Bishop Street, Honolulu, HI 96813, var. pag.

APPENDIX A: TABLES

Table 1

CNMI 1988 Annual Commercial Landings
Of Bottomfish Species

Species	Records	Pounds	Value	$/lb
Bottomfish	205	33,458.00	58,686.16	1.75
Gindai (flower snap)	1	68.00	119.00	1.75
Onaga (red snapper)	19	1,601.00	4,819.50	3.01
Opakapaka (pink snp)	6	261.00	676.30	2.59
Emperor (mafute)	12	2,462.00	4,750.95	1.93
** Total Bottomfish**	243	37,850.00	69,051.91	1.82
** TOTAL ALL SPECIES**	3,081	442,326.88	621,962.98	1.41

Table 2

CNMI 1988 Monthly Commercial Landings
Of Bottomfish Species

Species	Records	Pounds	Value	$/lb
** January **				
Bottomfish	16	3,535.50	6,032.38	1.71
Emperor (mafute)	1	115.00	258.75	2.25
** Total Bottomfish**	17	3,650.50	6,291.13	1.72
** TOTAL ALL SPECIES**	198	24,433.05	36,307.37	1.49
** February **				
Bottomfish	17	3,639.00	6,268.15	1.72
Onaga (red snapper)	1	38.00	152.00	4.00
** Total Bottomfish**	18	3,677.00	6,420.15	1.75
** TOTAL ALL SPECIES**	230	30,843.98	46,532.84	1.51
** March **				
Bottomfish	13	3,183.00	5,868.30	1.84
Onaga (red snapper)	2	130.00	373.00	2.87
** Total Bottomfish**	15	3,313.00	6,241.30	1.88
** TOTAL ALL SPECIES**	299	38,065.50	56,640.71	1.49

Table 2 (Cont.)

Species	Records	Pounds	Value	$/lb
** April **				
Bottomfish	27	3,216.00	5,622.75	1.75
Onaga (red snapper)	3	94.00	313.00	3.33
Opakapaka (pink snp)	1	11.00	27.50	2.50
** Total Bottomfish**	31	3,321.00	5,963.25	1.80
** TOTAL ALL SPECIES**	294	39,639.00	56,665.10	1.48
** May **				
Bottomfish	17	3,494.50	6,255.68	1.79
Onaga (red snapper)	1	55.00	275.00	5.00
Emperor (mafute)	1	19.00	30.40	1.60
** Total Bottomfish**	19	3,568.50	6,561.08	1.84
** TOTAL ALL SPECIES**	285	41,418.50	55,082.80	1.33
** June **				
Bottomfish	21	3,339.00	5,957.50	1.78
Onaga (red snapper)	3	739.00	1,517.00	2.05
Opakapaka (pink snp)	1	12.00	24.00	2.00
** Total Bottomfish**	25	4,090.00	7,498.50	1.83
** TOTAL ALL SPECIES**	279	45,400.00	61,609.35	1.36
** July **				
Bottomfish	40	6,761.00	11,488.50	1.70
** Total Bottomfish**	40	6,761.00	11,488.50	1.70
** TOTAL ALL SPECIES**	250	41,207.50	55,806.35	1.35
** August **				
Gindai (flower snap)	1	68.00	119.00	1.75
Onaga (red snapper)	3	146.00	471.00	3.23
Opakapaka (pink snp)	2	82.00	197.00	2.40
Emperor (mafute)	3	455.00	870.25	1.91
** Total Bottomfish**	9	751.00	1,657.25	2.21
** TOTAL ALL SPECIES**	305	56,210.75	75,744.33	1.35
** September **				
Bottomfish	17	1,712.00	3,069.55	1.79
Onaga (red snapper)	3	269.00	1,153.50	4.29
Opakapaka (pink snp)	1	108.00	307.80	2.85
Emperor (mafute)	2	309.00	585.80	1.90
** Total Bottomfish**	23	2,398.00	5,116.65	2.13
** TOTAL ALL SPECIES**	236	29,227.60	41,947.98	1.44

Table 2 (Cont.)

Species	Records	Pounds	Value	$/lb
** October **				
Bottomfish	9	1,485.00	2,572.50	1.73
Onaga (red snapper)	2	95.00	355.00	3.74
Emperor (mafute)	3	1,444.00	2,730.75	1.89
** Total Bottomfish**	14	3,024.00	5,658.25	1.87
** TOTAL ALL SPECIES**	279	41,480.00	57,742.05	1.39
** November **				
Bottomfish	28	3,093.00	5,550.85	1.79
** Total Bottomfish**	28	3,093.00	5,550.85	1.79
** TOTAL ALL SPECIES**	217	30,280.00	42,802.20	1.41
** December **				
Onaga (red snapper)	1	35.00	210.00	6.00
Opakapaka (pink snp)	1	48.00	120.00	2.50
Emperor (mafute)	2	120.00	275.00	2.29
** Total Bottomfish**	4	203.00	605.00	2.98
** TOTAL ALL SPECIES**	209	24,121.00	35,081.90	1.45

Table 3

Summary of the CNMI Commercial Bottomfish Fishery 1982-88

	1982	1983	1984	1985	1986	1987	1988
Total Commercial Landings (lbs)	150763	330752	444559	338428	410025	312186	442327
Bottomfish Landings Lbs.	11076	22683	33924	32780	23929	39772	37850
Bottomfish Landings $	18084	40003	59005	55396	45079	71868	69052
Average Price/Lb.	1.63	1.76	1.74	1.69	1.88	1.81	1.82
Percent Bottomfish to Total Commercial Landings	7.3%	6.8%	7.6%	9.7%	5.8%	12.7%	8.6%
Number of Recorded Species Landings	99	673	640	348	297	293	243
Number of Trips	50	533	492	283	229	237	211
Number of Fishermen	17	90	102	55	54	43	29
Bottomfish Catch/Trip	222	43	69	116	104	168	179
Catch of Fishermen with > 1000 lbs/yr	10373	10027	21729	24542	17767	33598	33854
Percent of Total Catch by Fishermen Landing > 1000 lbs	94%	44%	64%	75%	74%	84%	89%
Number of Trips by Fishermen Landing>1000 lbs/yr	25	140	252	195	124	134	159
Number of Fishermen Landing >= 1000 lbs/yr	2	6	8	5	7	6	5
Catch/Trip for Fishermen Landing 1000 > lbs/yr	415	72	86	126	143	251	213

Table 4

CNMI Commercial Bottomfish Landings
(Unallocated Miscellaneous Bottomfish)

SPECIES %	1982	1983	1984	1985	1986	1987	1988
Grouper	569	1091	2513	3368	1195	577	0
	5.14%	4.81%	7.41%	10.27%	4.99%	1.45%	0.00%
Jacks	574	825	725	770	655	486	0
	5.18%	3.64%	2.14%	2.35%	2.74%	1.22%	0.00%
Gindai	11	214	639	166	699	217	68
	0.10%	0.94%	1.88%	0.51%	2.92%	0.55%	0.18%
Lehi	0	0	0	0	0	0	0
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Onaga	199	894	821	894	1278	378	1601
	1.80%	3.94%	2.42%	2.73%	5.34%	0.95%	4.23%
Opakapaka	86	1618	1311	545	790	917	261
	0.78%	7.13%	3.86%	1.66%	3.30%	2.31%	0.69%
Emperor	2383	7644	11140	9341	7400	12455	2462
	21.51%	33.70%	32.84%	28.50%	30.92%	31.32%	6.50%
Amberjack	0	0	0	108	0	0	0
	0.00%	0.00%	0.00%	0.33%	0.00%	0.00%	0.00%
Uku	0	0	0	65	291	0	0
	0.00%	0.00%	0.00%	0.20%	1.22%	0.00%	0.00%
Bottomfish	7257	10398	16777	17523	11622	24743	33458
	65.50%	45.84%	49.45%	53.46%	48.57%	62.21%	88.40%
TOTAL Bottomfish:	11079	22684	33926	32780	23930	39773	37850

Table 5

CNMI Commercial Bottomfish Landings
(Allocated Miscellaneous Bottomfish)

SPECIES %	1982	1983	1984	1985	1986	1987	1988
Grouper	1649	2014	4971	7236	2323	1527	0
	14.89%	8.88%	14.65%	22.08%	9.71%	3.84%	0.00%
Jacks	1664	1523	1434	1654	1273	1286	0
	15.02%	6.71%	4.23%	5.05%	5.32%	3.23%	0.00%
Gindai	32	395	1264	357	1359	574	586
	0.29%	1.74%	3.73%	1.09%	5.68%	1.44%	1.55%
Lehi	0	0	0	0	0	0	0
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Onaga	577	1651	1624	1921	2485	1000	13797
	5.21%	7.28%	4.79%	5.86%	10.38%	2.51%	36.45%
Opakapaka	249	2987	2594	1171	1536	2427	2249
	2.25%	13.17%	7.64%	3.57%	6.42%	6.10%	5.94%
Emperor	6908	14113	22038	20069	14388	32959	21217
	62.35%	62.22%	64.96%	61.22%	60.12%	82.87%	56.06%
Amberjack	0	0	0	232	0	0	0
	0.00%	0.00%	0.00%	0.71%	0.00%	0.00%	0.00%
Uku	0	0	0	140	566	0	0
	0.00%	0.00%	0.00%	0.43%	2.36%	0.00%	0.00%
TOTAL Bottomfish:	11079	22684	33926	32780	23930	39773	37850

APPENDIX B: FIGURES

Figure 1

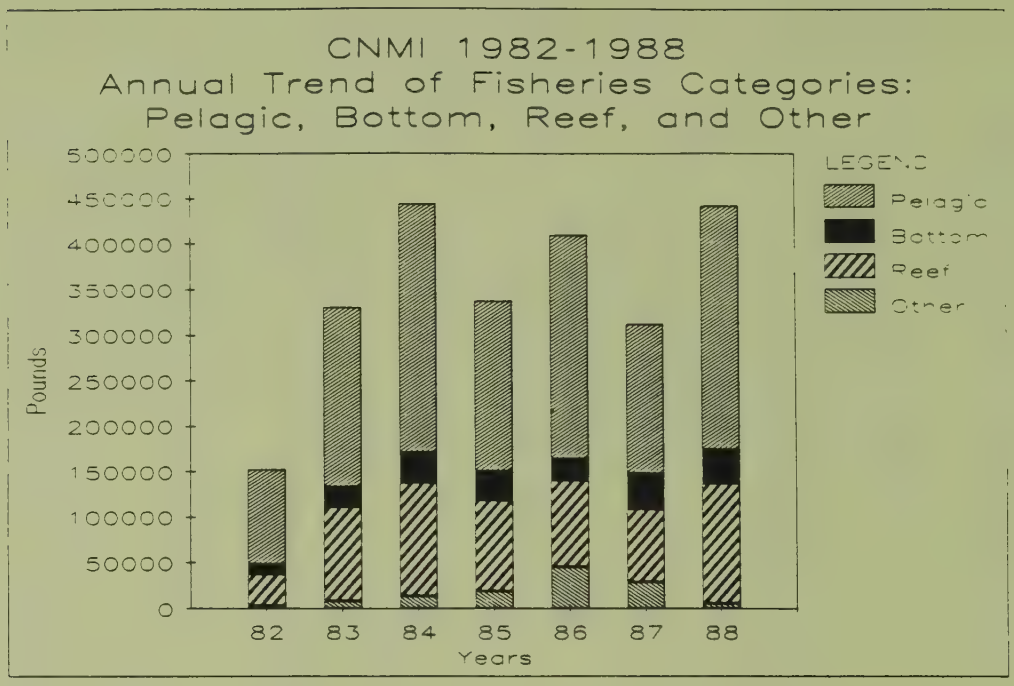
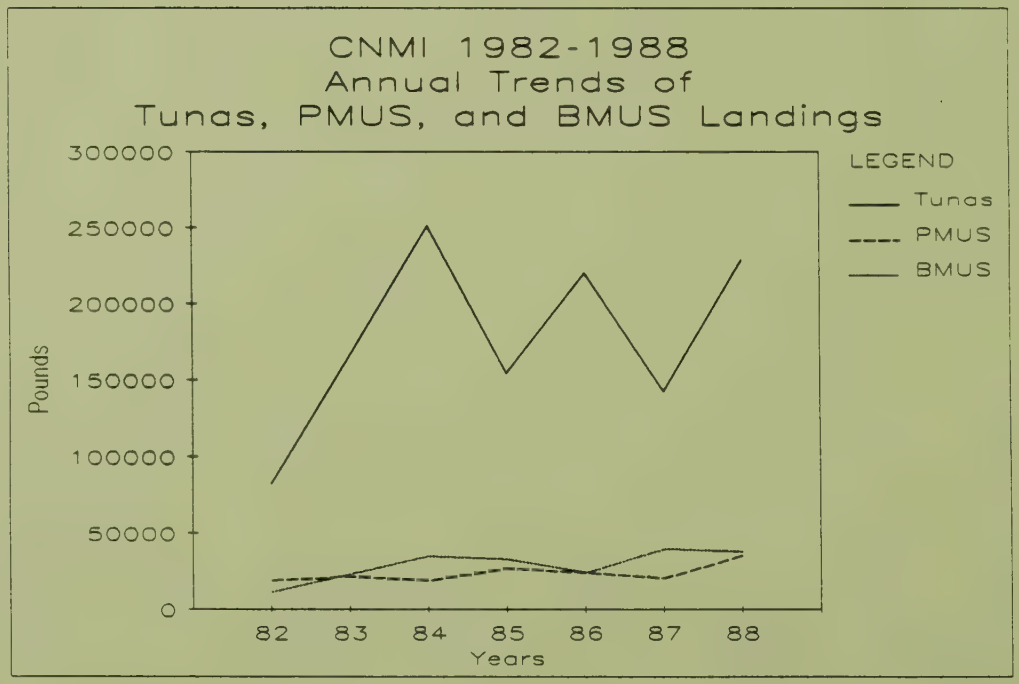


Figure 2



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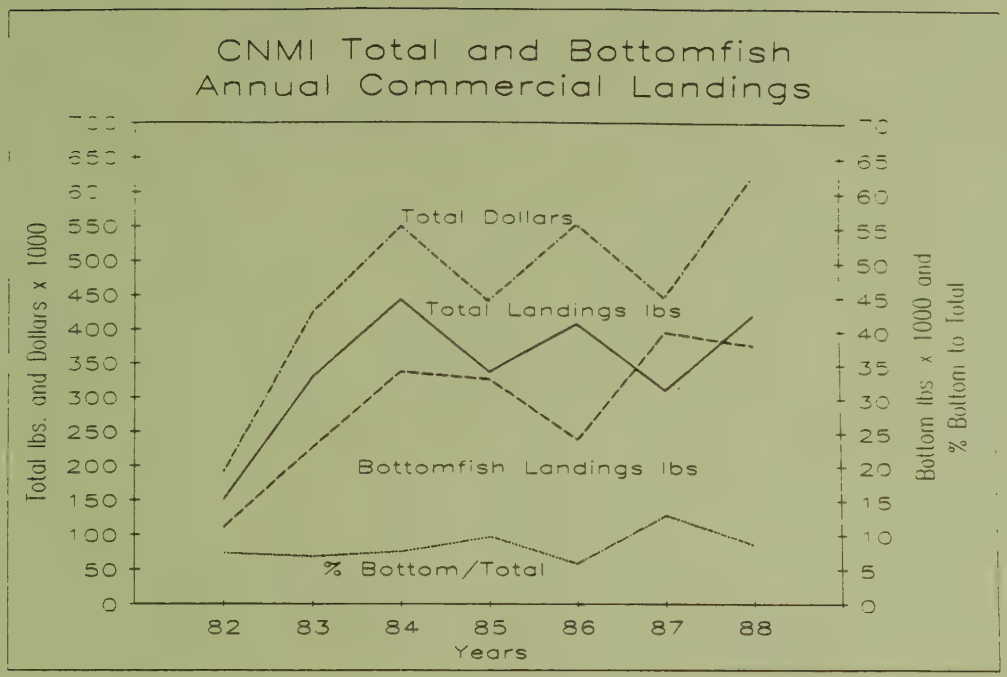

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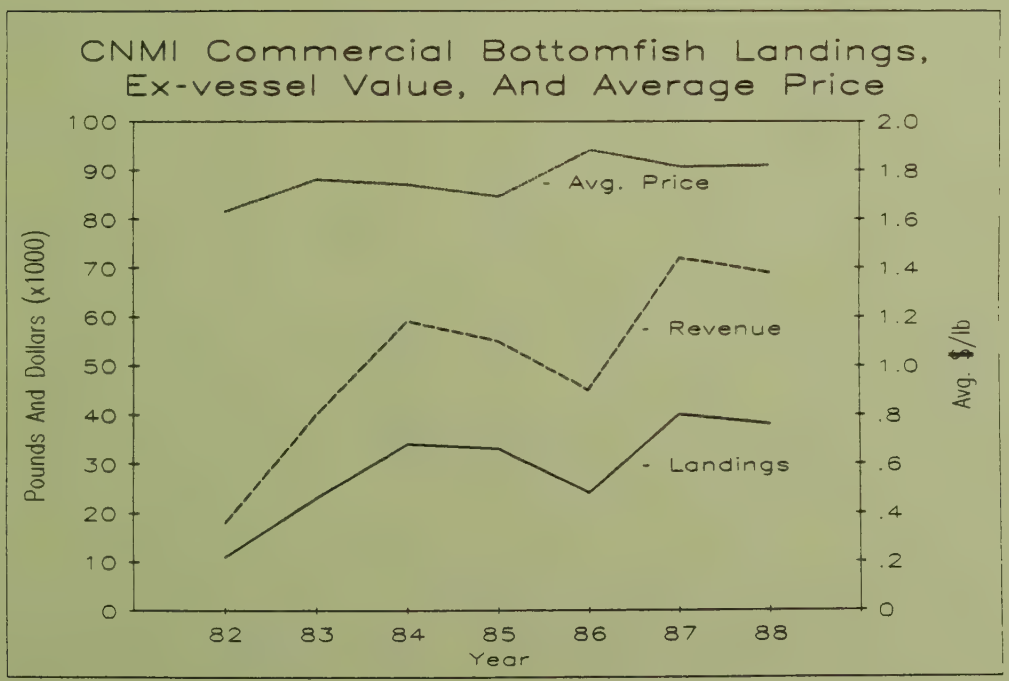
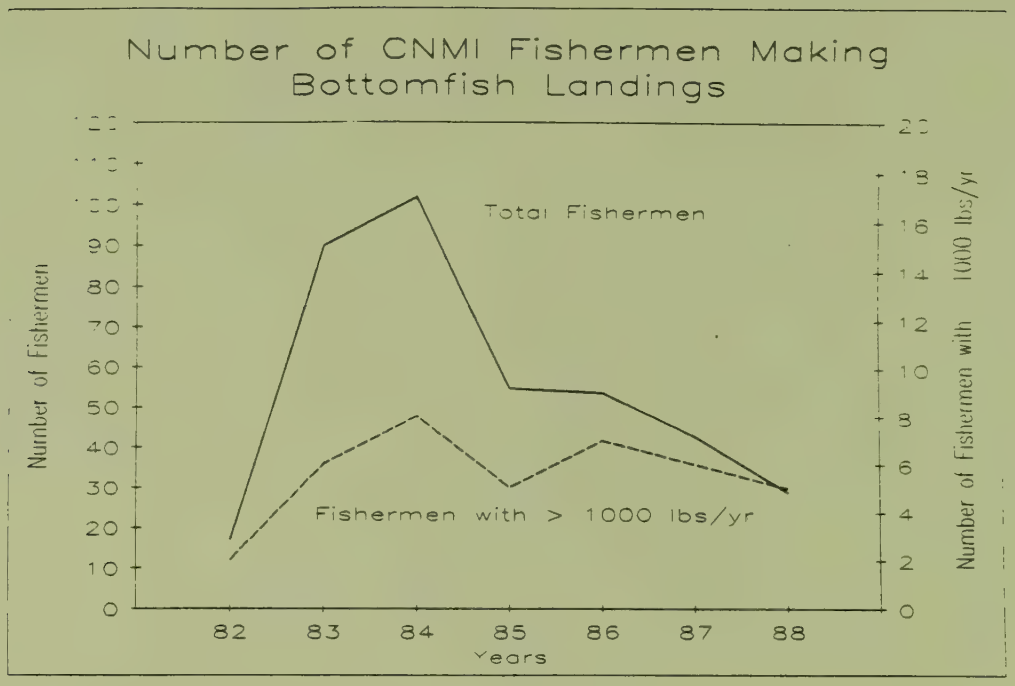


Figure 5



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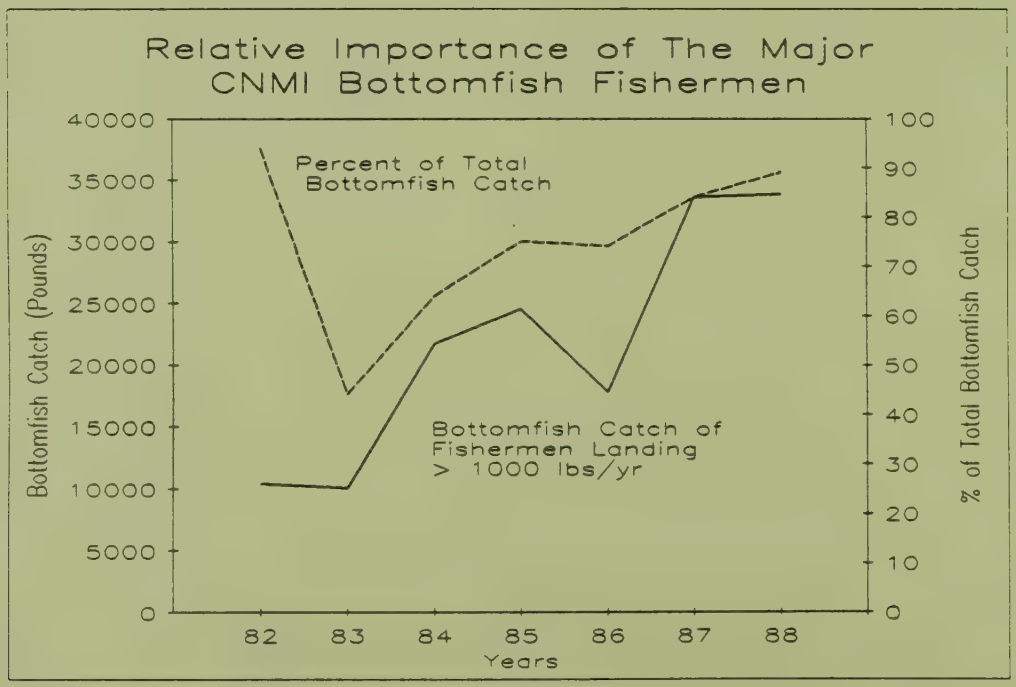


Figure 7

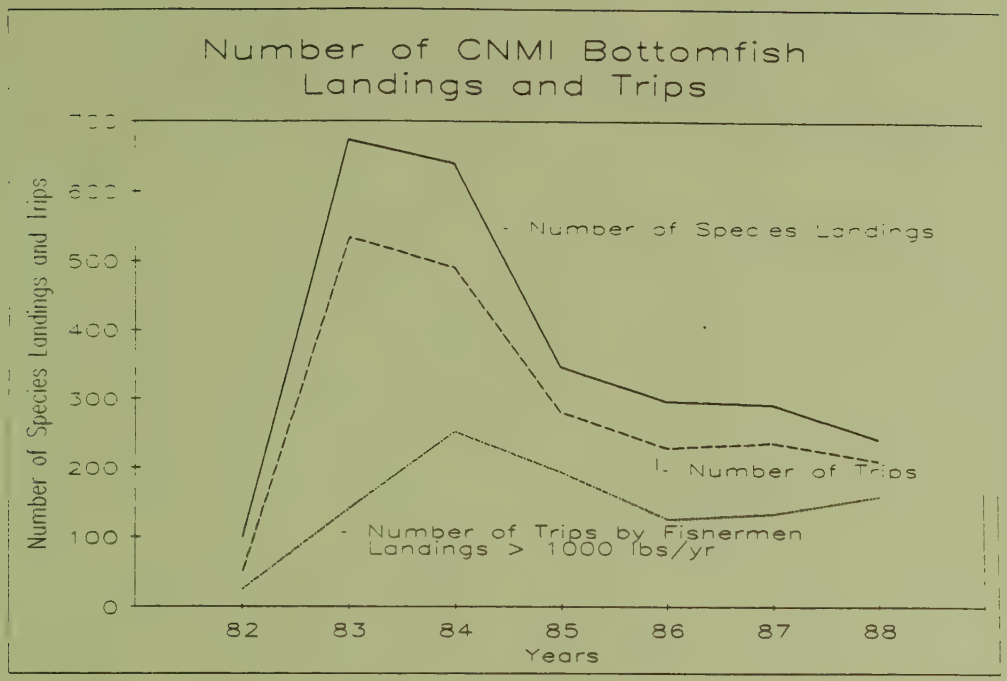


Figure 8

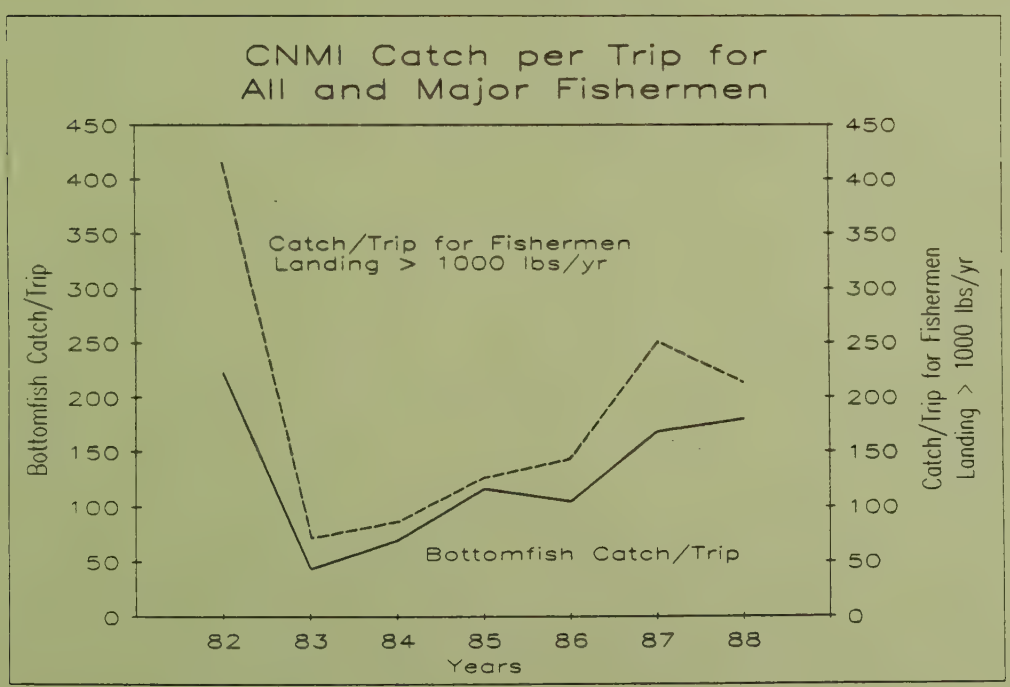


Figure 9

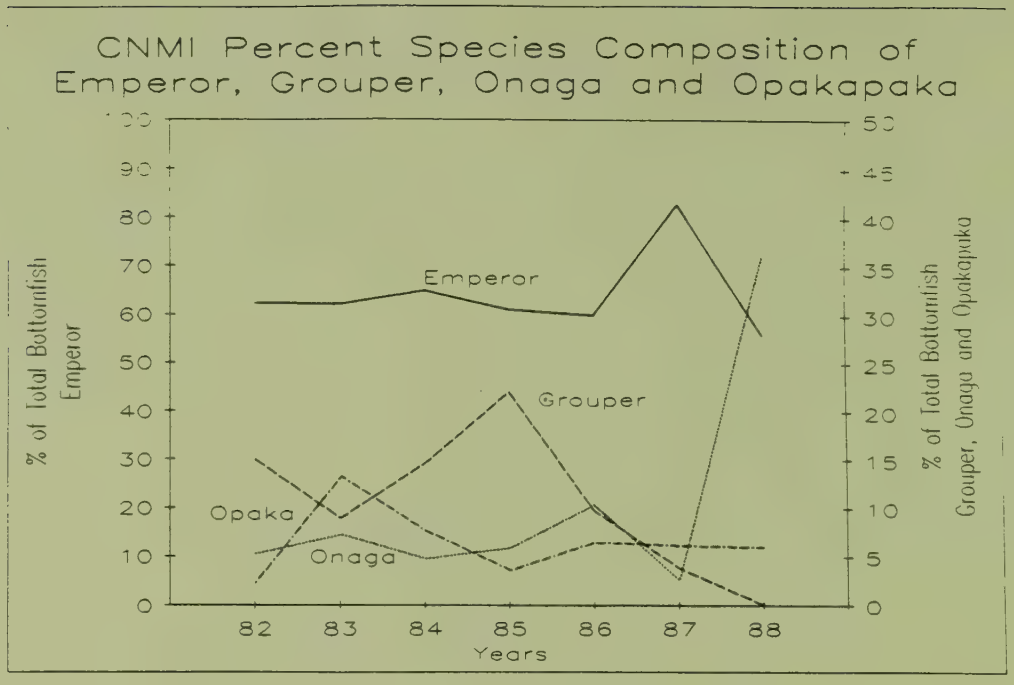
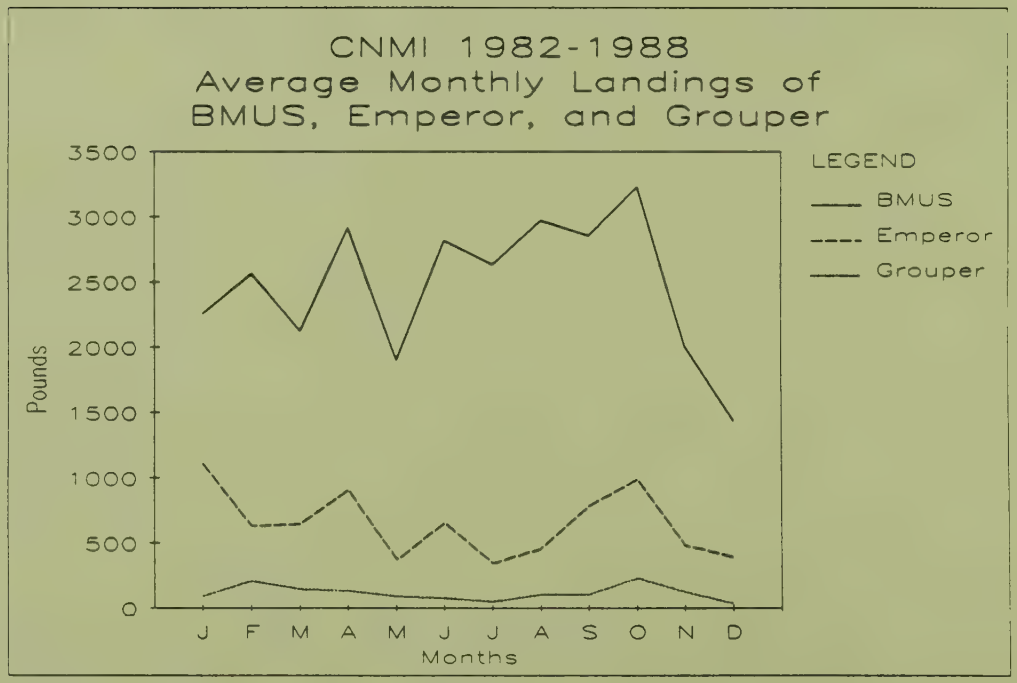


Figure 10



APPENDIX 6

BOTTOMFISH HABITAT CONDITIONS AND NMFS ADMINISTRATIVE ACTIONS - 1988

JUNE 1989

Prepared by

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for the

Western Pacific Regional Fishery Management Council's

BOTTOMFISH PLAN MONITORING TEAM

HABITAT CONDITIONS AND RECENT ALTERATIONS

Under the FMP, regulations were implemented to prohibit the use of bottom trawls, bottom-set nets, explosives and poisons for harvesting bottomfish. This has served to greatly reduce the potential for bottomfish habitat degradation. To our knowledge, there have been no violations of these regulations in 1988.

As reported in the 1987 annual report, there are several activities occurring or reportedly occurring in the FCZ which potentially may alter bottomfish habitat. These include:

1. Anchor damage by vessels attempting to maintain position over productive bottomfish habitat.

2. Habitat damage from heavy weights and line entanglements during normal hook-and-line bottomfish operations.

3. Habitat damage by illegal foreign fishing activities for precious corals using coral dredges.

During 1988, the NOAA Fisheries' Honolulu Laboratory initiated an investigation to identify the habitat requirements of juvenile snappers in the Hawaiian islands. Adult snappers are known to be associated with structural relief at depths of 100 to 150 meters. The preliminary investigations have demonstrated the presence of juveniles of recreational and commercially important snappers (Pristipomoides filamentosus, Aprion virescens, Aphareus rutilans) in habitat relatively close to the fishing grounds for adults but not where adults congregate. Although the boundaries of the habitat and the characteristics that make it attractive to juveniles remain to be defined, initial results indicate juveniles occupy a flat, open bottom of primarily soft substrate in depths ranging from 40 to 73 m. The occurrence of juvenile snappers in relatively shallow water and on featureless bottom habitat indicates the potential for considerable importance of an area of ocean bottom previously thought to be of minimal importance as fishery habitat.

An activity which potentially may impact bottomfish habitat is a proposal to lease 26,910 square kilometers of the EEZ surrounding the Hawaiian Archipelago and Johnston Island for mining of cobalt rich manganese crusts. A joint State-Federal Task Force, which includes a staff member from the NMFS Habitat Conservation Program, has been created to develop an environmental impact statement (EIS) for the proposed activity. The Draft EIS, "Proposed Marine Mineral Lease Sale in the

Hawaiian Archipelago and Johnston Island Exclusive Economic Zones", has been published. The Final EIS will be published in the summer of 1989.

NOAA Fisheries initiated a bottomfish habitat enhancement program in October 1985 when a series of deepwater artificial reefs were placed on the bottom at Penguin Bank. Initial surveys indicate a substantial increase in biomass of bottomfish at these sites. Monitoring of the artificial reefs will continue for at least another two years.

The potential threat to bottomfish habitat now is being reviewed through the Council's newly established Ecosystems and Habitat Committee. The Council has adopted a Habitat Policy which will assure that each fishery management plan includes all available information on habitat significant to the species to be managed.

NMFS ADMINISTRATIVE ACTIONS

The principal administrative action for the NMFS was to prepare for implementation of the Northwestern Hawaiian Islands limited entry program, which became effective January 1, 1989. The NMFS, in cooperation with the Hawaii Division of Aquatic Resources (HDAR) and the Council, developed an operations plan to guide the implementation process. The Pacific Area Office, Southwest Region, distributed information packets to all holders of permits for the bottomfish fishery as well as to persons who had been known to fish in the NWHI in the past. The information packets included a copy of the limited entry regulations and the new limited entry permit application forms. Prospective applicants were advised to file early in the event they anticipated being on the grounds on January 1, 1989. Arrangements were made with HDAR to provide certification of the validity of copies of bottomfish landings reports filed with permit applications.

As of mid-May 1989, the NMFS had issued 17 permits: 8 for the Ho'omalu Zone and 9 for the Mau Zone. In addition, one individual has been told he would qualify for a Ho'omalu Zone permit when he obtains a vessel for use in those waters, and another individual reportedly is trying to compile information to support an application for the Ho'omalu Zone based on financial commitments prior to the cutoff date for eligibility. The relatively low number of permits requested in the fishery probably reflects several factors:

1. Vessels that shifted out of bottomfish into tuna longlining or other fishing have not returned to bottomfish fishing.

2. The limited entry program would forestall new entry.

3. The limited entry program provides a five-year window during which to apply for a first permit for the Ho'omalu Zone based on historic participation.

Thus, there is no pressure to force vessels to return to bottomfish fishing before conditions are favorable. In any event, it appears there is a substantial number of eligible but non-participating fishermen for the bottomfish fishery.

The evaluation of the first year under the limited entry plan will begin shortly after the end of 1989. The SWR intends to work with NMFS Enforcement, the Coast Guard, HDAR, Council staff, and the Council's Bottomfish Plan Monitoring Team and Bottomfish Industry Advisory Board to develop an outline of the evaluation report in the second half of 1989.

APPENDIX 7

ENFORCEMENT ACTIVITIES - 1988

JUNE 1989

Prepared by

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Western Pacific Regional Fishery Management Council's

BOTTOMFISH PLAN MONITORING TEAM

ENFORCEMENT ACTIVITIES

There were no reported violations of bottomfish regulations in 1988 requiring action by NMFS enforcement officers. Enforcement monitoring activities specific to this fishery were limited to ensuring vessel compliance with the NWHI permit requirement and with prohibitions on the use and possession of destructive fishing gear.

There were no reported incidental takes of or fishery interactions with protected species by NWHI permitted vessels in 1988.

Tables 1 and 2 summarize enforcement patrols in 1988. These patrols were not limited to the Bottomfish and Seamount Groundfish Fishery but obviously contributed to monitoring and enforcement in that fishery. NMFS Enforcement agents accompanied all patrols. Tables 3 and 4 show the gear type and nation of origin for foreign vessels sighted in the region.

Table 1. 1988 aircraft and surface vessel patrols, and foreign fishing vessel (FFV) sightings in the western Pacific.

C-130 Aircraft

	Miles		Hours	
	1987	1988	1987	1988
Jan	3501	1680	14.9	7.2
Feb	4884	0	22.1	0
Mar	3645	1232	16.5	5.0
Apr	7425	0	33.1	0
May	4887	0	20.5	0
Jun	6077	3080	26.6	14.0
Jul	5980	5912	26.0	27.5
Aug	3030	5894	14.1	27.8
Sep	8588	9094	41.2	40.6
Oct	7010	8915	26.8	39.1
Nov	7257	2244	32.4	10.2
Dec	4805	0	20.5	0
Total	67089	38051	294.7	171.4

Surface Vessels

	Miles		Hours	
	1987	1988	1987	1988
Jan	2476	1050	9	6
Feb	3703	725	15	5
Mar	1300	810	9	6
Apr	400	0	4	0
May	2280	0	10	0
Jun	4578	1760	21	11
Jul	1850	2340	10	13
Aug	1740	3625	9	25
Sep	410	320	3	3
Oct	2040	1005	8	8
Nov	1450	410	7	3
Dec	0	0	0	0
Total	22227	12045	105	80

	Total Miles Patrolled		FFVs Sighted within U.S. EEZ	
	1987	1988	1987	1988
Jan	5977	2730	2	2
Feb	8587	725	7	0
Mar	4945	2042	1	0
Apr	7825	0	4	0
May	7167	0	2	0
Jun	10655	4840	4	4
Jul	7830	8252	1	3
Aug	4770	9519	0	2
Sep	8998	9414	1	11
Oct	9050	9920	7	3
Nov	8707	2654	7	0
Dec	4805	0	0	1
Total	89316	50096	36	26

Table 2. 1988 patrols by geographic area. MHI = Main Hawaiian Islands, NWHI = Northwest Hawaiian Islands, GM/NM = Guam and the Northern Mariana Islands, JI = Johnston Island, H&B = Howland and Baker, AS = American Samoa, JARV = Jarvis, PALM = Palmyra Island.

Surface Vessel Days

	MHI	NWHI	GM/NM	JI	H&B	AS	JARV	WAKE	PALM	Total
Jan										0
Feb										0
Mar										0
Apr										0
May										0
Jun										0
Jul	2	9	2							13
Aug	8	10	5	2						25
Sep			3							3
Oct	2		4	2						8
Nov			3							3
Dec										0
Total	12	19	17	4	0	0	0	0	0	52

Aircraft Hours

	MHI	NWHI	GM/CM	JI	H&B	AS	JARV	WAKE	PALM	Total
Jan										0
Feb										0
Mar										0
Apr										0
May										0
Jun										0
Jul	2.2	14.8	10.5							27.5
Aug	3.9	20.4		3.5						27.8
Sep		12.1	28.5							40.6
Oct	7.8	15.0		5.0	2.0	9.3				39.1
Nov		10.2								10.2
Dec										0
Total	13.9	72.5	39.0	8.5	2.0	9.3	0	0	0	145.2

Table 3. Monthly foreign vessel sightings. LL = longline, PL = pole-and-line, OT = other, TOT = total.

	Hawaii				Guam/CNMI				Am. Samoa				Other				All Areas			
	LL	PL	OT	TOT	LL	PL	OT	TOT	LL	PL	OT	TOT	LL	PL	OT	TOT	LL	PL	OT	TOT
Jan	1	1		2				0				0				0	1	1	0	2
Feb				0				0				0				0	0	0	0	0
Mar				0				0				0				0	0	0	0	0
Apr				0				0				0				0	0	0	0	0
May				0				0				0				0	0	0	0	0
Jun	3	1		4				0				0				0	3	1	0	4
Jul				0	3			3				0				0	3	0	0	3
Aug	2			2				0				0				0	2	0	0	2
Sep				0	10		1	11				0				0	10	0	1	11
Oct				0				0				0				0	0	0	0	0
Nov	1			1				0	2			2				0	3	0	0	3
Dec	1			1				0				0				0	1	0	0	1
TOT	8	2	0	10	13	0	1	14	2	0	0	2	0	0	0	0	23	2	1	26

Table 4. Nationality of foreign vessels sighted.

	Japan	S. Korea	Taiwan	Total
Jan	2			2
Feb				0
Mar				0
Apr				0
May				2
Jun	4			4
Jul	3			3
Aug	2			2
Sep	9	1	1	11
Oct	1	2		3
Nov				0
Dec	1			1
Total	22	3	1	26